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REDUCING THE ELECTRIC-VEHICLE FIRE RISK.

Since its earliest days it has been the justified pride of the electric vehicle that in comparison with the gasoline automobile and truck the fire hazard has been practically insignificant, and in recognition of this point storage-battery trucks and pleasure cars are generally admitted to docks, warehouses and wharves where the use of the gasoline-driven machines is absolutely prohibited. Nevertheless a small fire risk exists in the electric vehicle, and insurance engineers perform a real service to the industry when they point out some of the weak spots and suggest lines of improvement, for in this field it really looks as though close to perfection might soon be attained.

In a suggestive paper read this week before the Boston convention of the Electric Vehicle Association of America, Mr. Carl H. Clark reviews the few principal causes of fires which are associated with this type of equipment. The most common difficulty appears to arise from the overheating of resistance coils resulting from the accidental throwing on of the current after the car has been stopped, without drawing the plug, and with the brakes set. The control lever is thrown from neutral into first speed by catching in the sleeve or skirts as the operator leaves the car. The same result has been noted where the car has moved a few feet and brought up against a wall or snowbank. The remedy suggested is the use of a latch on the control lever, similar to that fitted on some selective types of transmission, to prevent accidental throwing into reverse. It might also be desirable to so arrange the connections that the setting of the brake would automatically break the circuit, and some means of practically compelling the drawing of the plug when leaving the car would be of great assistance.

Excessive operation of cars on resistance at low speeds has in some instances caused fires, and the remedy appears to be the provision of more air space around the resistance, with better insulation of the woodwork. There appears to be an opportunity for further improvement in the wiring of some vehicles, notably by running feeds in metal or fiber conduit, with the use of junction boxes, the arrangement of conductors to avoid rubbing of insulation and swinging of flexible leads, the use of thimbles of fiber or rubber where wires leave conduit or fittings, and the covering of bare spots in the electrical circuits. Still

further gains might be made by avoiding the use of open flame lights of any kind around batteries under charge and the use of a slightly flexible mounting of batteries to avoid damage from shocks.

Considering the critical powers of our insurance friends, we think that the electric vehicle makes a pretty satisfactory showing in the face of the above suggestions, and that the lines of improvement covered lie chiefly in the direction of making the products of the factories as nearly proof against carelessness as is possible. Certainly, the enormously greater safety of the electric vehicle from the fire-risk side is one of its best talking points; one which has had powerful influence in its selection in the past for service in congested buildings and areaways, and one which needs but little more improvement to justify still further reduction in insurance rates.

THE NEW WIRELESS REGULATIONS.

At the last session of Congress an act was passed to regulate radio communication, and in addition to placing certain restrictions upon the operation of wireless apparatus, operators of such apparatus are required to secure licenses from the Secretary of Commerce and Labor and to conform to certain regulations to be issued by him. The act becomes effective on December 13, 1912.

In conformity with this law the Secretary of Commerce and Labor has, under date of September 28, issued the regulations which shall govern the granting of licenses and the operation of wireless apparatus. Nine districts have been established, with headquarters at Boston, New York, Baltimore, Savannah, New Orleans, Cleveland, Chicago, San Francisco and Seattle. Radio inspectors, with offices in the respective customs houses, will have charge of the enforcement of the law and the regulations. Examinations for operators will be held at navy yards, naval stations, army posts, the Bureau of Standards, etc. Nine grades of operators' licenses are provided for, including five commercial grades, two amateur grades and two technical grades. For a first-grade commercial license an operator must understand the adjustment, care and operation of the apparatus and be capable of transmitting or receiving at the rate of 20 words per minute. He must also show a familiarity with the law and the international regulations of the Berlin Convention. Amateurs must meet the same requirements, except as to speed of transmission. Women are eligible for licenses.

All licensees are pledged to secrecy regarding received messages which are intended for other persons.

The regulations which have been issued to cover examinations and the issuing of licenses seem entirely reasonable and will not work any hardship upon any of the interests involved, whether commercial or amateur. Whether the same may be said of all the restrictions incorporated in the act of Congress remains to be demonstrated by experience. That act provides that no wave-lengths between 600 and 1,600 meters shall be used by commercial stations, while amateurs are restricted to wave-lengths less than 200 meters. All ship stations and all coast stations open to general public service must be prepared to use two sending wave-lengths, of 300 and 600 meters respectively. All stations in these two classes are required to receive messages from any other such station, regardless of the system of apparatus used.

CO-OPERATION IN THE PURCHASE OF ELECTRIC TRUCKS.

In the introduction of any new agency of a labor-saving character into the industrial field, many difficulties must be overcome. The intrinsic merit of a device or piece of apparatus may be all that the manufacturers claim, but unless its adaptation to the desired service is carried forward on sound engineering lines and with the co-operation of all responsible employees of the purchaser, serious harm may be done to the particular industry which is being provided with new tools and methods, to say nothing of the possible discrediting of the new apparatus.

The substitution of the electric truck for horse or gasoline traction offers a case in point. More and more purchasers of motor vehicles base their actions upon carefully prepared estimates and guarantees, and month by month it is becoming increasingly difficult to place equipment of this kind in service by methods of salesmanship which may be effective in the disposal of ready-made clothing or fancy neckwear. Co-operation is a threadbare word, perhaps, but it must be practiced by both dealer and purchaser if satisfactory results are to be attained. Thus, where a truck is being designed to meet a special condition, such as handling trunks in a low terminal basement hampered by steel columns, the purchaser should not lose sight of his responsibility in providing the bidder every possible facility of investigation in connection with the proposal to be made, and on the other hand, the manufacturer's representative should not overlook the supreme importance of verifying important measurements and clearances, and seeing to it personally that his factory engineers are supplied with complete and accurate information. Otherwise, and this is no imaginative situation, the product when delivered may not fit the conditions as to effective minimum radius of action or overhead clearance; its capacity may be equal to the demands upon it, and unless it is handled sympathetically when placed in service in direct competition with the horse, it may be discredited by having no opportunity to show its real merits. That is, hostile handling may delay the work of loading or unloading so long that the machine makes a poor showing in comparison with its older competitors, with the result that both purchaser and dealer are dissatisfied.

COMPARISONS WITH ELECTRIC MOTORS.

In estimating the cost of operation by means of electric drive and other forms of drive it is quite customary to base the estimate upon full-load operation of the machinery and upon continuous operation throughout the working hours of the year. In making a comparison between the cost of electric drive and drive by means of gas or gasoline engines, this basis of estimate is particularly favorable to the latter and unfavorable to the electric motor, in any case where the assumed conditions of operation are not complied with. This arises from the fact that the mere operating costs of both gas and gasoline motor are, at prices usually prevailing, less than the mere operating cost of the electric motor; whereas, the fixed charges and cost of repairs, etc., are likely to be much higher. The initial cost for an electric motor of a given capacity is much less than that for either of the other two forms of motor mentioned. Consequently, when machinery is not operated throughout the total hours used in the estimate, the cost per horsepower-hour of the energy delivered will increase more rapidly for a gas or gasoline motor than for an electric motor. An estimate of costs for motors of small capacity has been made by Mr. E. Vollhardt and published in a recent issue of the *Elektrotechnische Zeitschrift*. It shows that in the case of a 10-horsepower motor, for example, the increase in cost per unit of energy when the number of working hours per year has diminished from 3,000 to 1,000 is less than 10 per cent for an electric motor. When the working hours per year are decreased to 500, the increase is still less than 20 per cent. With a gasoline motor, on the other hand, the unit cost in the latter case is about double, and the same holds true for the gas engine, prevailing prices being used for the computation in each case.

A similar result is found when the motor, instead of being operated at full capacity, is used with only a partial load. Thus, when an electric motor of from 0.5 to 12.5 horsepower is operated at half load, the cost per unit of delivered energy rises by an amount not exceeding 15 per cent; whereas, with a combustion motor, the increase is over 30 per cent. Operation at one-quarter load means with a combustion motor an increase in the unit cost of 92 per cent; whereas, with the electric motor the increase is only from 10 to 35 per cent, depending upon the size of the motor.

It is well to keep in mind the effect of these conditions of operation upon the cost of power in small-motor installations, since it is seldom in minor applications of power that a machine is operated continuously at full load. While estimates based upon such continuous operation will sometimes show to the advantage of other forms of motive power, it is seldom that such an advantage is realized in practice. This constitutes an effective argument for the solicitor who is advocating the installation of electric drive, especially where small units are involved.

GAS COMPETITION IN STREET LIGHTING.

Development of street lighting in this country has been in the direction of displacing the old installations of gasoline and gas lighting by electrical equipment, and nearly every new installation in the last twenty years has been of the latter variety. Formerly arc lamps were the rule, but of late years series tungsten lamps have been sharing attention with the more intense units. In Europe the development has not been so one-sided, and many installations of gas lighting upon the streets of large cities are to be noted. These are not, however, of the type to which we are accustomed here, but consist of lamps using illuminating gas under high pressure, that is to say, a pressure of two pounds per square inch, instead of one or two ounces per square inch, as is customary in the service mains of most gas companies.

High-pressure gas lighting is not unknown in this country. New York, Chicago, Philadelphia and other cities have seen trial installations, but in none of them has it found general use for street lighting. Indeed, gas has hardly been considered a competitor with electric lighting in American cities. Whether this condition is to be changed remains to be seen, but there is little likelihood that gas lighting will come again into favor. A type of lamp for high-pressure gas has been developed which is suited to American weather conditions, and others are likely to soon be upon the market. However, the low price of gas which is prevalent in European cities is not likely to be duplicated in America, and it is necessary to bring the price down to 50 cents per thousand cubic feet or lower in order that operation and maintenance costs shall be upon a competitive basis. This assumes that the luminous efficiency is twice as good with high-pressure gas as with low-pressure gas.

Other considerations than cost are likely to enter into a choice of illuminants, however, and one of these is the amount of attention required. The inclosed-arc lamp displaced the open arc of the early days largely because it required much less frequent trimming, and a similar consideration may militate against the introduction of the modern type of high-candlepower street gas lamp, which requires frequent trimming, since the average life of mantle is only ten days. This life is likely to be increased several times, however, by the use of mantles built upon artificial silk as a base. But with the luminous and long-burning flaming arcs now available; with tungsten lamps of long life, high efficiency and great stability, standardized as to current rating for series service; and the quartz-tube mercury-vapor lamp of high candlepower and acceptable color value, needing slight attention; the chances for the gas lamp, even with the high candlepower and high efficiency made possible by the use of high pressure in the main, do not seem very favorable for any general adoption in American street-lighting practice in the near future.

Organization Meeting of the Society for Electrical Development.

Practically the entire organization committee selected at the Association Island meeting of representative electrical men, was present at a meeting held at the Engineering Society's Building in New York City on Thursday, October 3. It was decided to incorporate along the lines suggested at the preliminary meeting, which was fully reported in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for September 14, the name to be "The Society for Electrical Development." Papers of incorporation were practically agreed upon, and it was arranged to incorporate the new society at an early date so that the whole matter can be discussed and definite action taken at the meeting which will be held at the Engineering Society's Building in New York on October 18. A constitution and by-laws were approved, and at the meeting on October 18 it is expected that arrangements for the organization work and the appointment of officers and committees and plans for financing will be prepared.

Electrical Development in Colorado.

In a recent address before the Denver Real Estate Exchange, President W. G. Mathews of the Colorado Electric Club gave some very interesting statistics relative to the electrical industry in Colorado. He stated that there are 24,000 people in the state engaged in electrical occupation and that about 64,000 are deriving their livelihood from the electrical industry either directly or indirectly. Six thousand of these, he stated, live in Denver.

In speaking of the electric railways in the state, he said that 16 companies were operating in the state, covering a total of 500 miles with 900 cars. There are also 150 central stations, which generate approximately 2,000,000 horsepower. The transmission lines of the power companies are being extended over long distances, 140,000 volts being used. Experiments are being made with 200,000 volts.

Educational Campaign of N. E. L. A.

At the Seattle convention of the National Electric Light Association a Publication Committee was organized, of which the chairman is Douglas Burnett, of Baltimore, Md. The committee met in Boston on October 2 and 3. The committee has charge of the educational publications of the Association and has planned the publication of three books devoted to electricity in the home, electrical service for merchants and the use of small motors.

Production of Electric-Furnace Steel.

According to Robert Pinot, secretary-general of the Comités des Forges de France, the production of steel in electric furnaces during the last three years was, in tons:

	1909.	1910.	1011.
Germany	17,773	36,188	66,654
United States	13,762	52,141	29,105
Austria-Hungary	9,046	20,028	22,867
France	6,456	11,759	13,850
Total	47,039	120,116	126,476

The United Kingdom had hardly commenced to produce for the general market. The predominating lead of Germany and the drop in the electric-steel production of the United States are notable features of last year's figures. Activity in France lies more in the field of ferro-alloys. Of these, France made altogether, in 1904, 34,200 tons, which amount had increased to 60,200 tons by 1910; the figures for ferro-alloys made in electric furnaces were respectively 5,756 and 23,800 tons; the electrically produced alloys amounted in 1909 to 14,900 tons, and varied little in the years 1906 to 1909.

Illinois State Convention.

The Illinois State Electric Association will hold its annual convention at the Jefferson Hotel, Peoria, Ill., October 22 to 24. Sessions will be held on Tuesday afternoon, Wednesday morning and afternoon, Thursday morning and afternoon, the last session being an executive session. A banquet will be held on Tuesday evening and on Wednesday evening there will be a parlor entertainment. Entertainment for the ladies during the sessions of the convention has also been arranged.

No arrangement has been made this year for a general exhibit.

R. S. Wallace, Peoria, Ill., is chairman of the committee in charge.

No Denver Show This Year.

Owing to the revival of the Mountain and Plain Festival in Denver, The Colorado Electric Club has decided to abandon giving its annual electric show this year. It is said, however, that next year's exposition will be one of the best the club has undertaken and will be one of the largest ever given in the country. Plans are already being formulated for the 1913 show and a number of committees are busily engaged in perfecting details.

Boston Telephone Meeting.

The regular meeting of the Boston Plant Chapter of the Telephone and Telegraph Society of New England will be held on October 15 at 8 p. m. in the Auditorium of the Edison Building, Boston, Mass. J. G. Patterson of the New England Telephone & Telegraph Company will deliver an address on "Toll-Line Studies."

Electrical Illumination of Aeroplanes.

On the evening of September 26 a very fine and novel effect was produced at the London Aerodrome at Hendon, England, electricity being used for the illumination of a number of flying machines which took part in a popular display. The newspaper press describes the display as "fascinating." "Everything and everybody seemed to be illuminated. The stewards had illuminated buttonholes. The mechanics had an illuminated motor-car. The inclosures, marquees and stands were outlined in many colored electric lights. . . . Powerful searchlights sent frequent messages from the earth to the air. . . . Several of the machines which took part in the demonstration, besides carrying searchlights and side and rear lights, had their planes outlined with electric bulbs fed from portable accumulators." Some of the flyers exchanged messages with the judges by searchlights.

R. T. Gates went up in an illuminated 80-horsepower Henry Farman hydro-aeroplane fitted with a searchlight of 200,000 candlepower, and a number of others also went up in electrically lighted machines.

European Utilities.

"European Utilities" was the subject of Emil C. Braun's address at the meeting of the Byllesby Luncheon Club, in Chicago, on Oct. 2. Mr. Braun dwelt upon the extent to which electricity is used in Europe for farming purposes, and expressed the belief that this class of business could profitably be served in the United States. The subject was discussed by Mr. Hofman, of the Engineering Department, and Mr. Norsa, of the Examination and Reports Department.

New York Telephone Meeting.

The Telephone Society of New York will hold its 138th meeting at 29 West Thirty-ninth Street, New York City, on October 15, at 8:15 p. m. J. A. Stewart, general manager of the New York Telephone Company, will present a paper entitled "A Short Review of the Progress Made by the New York Telephone Company Since 1892."

Electrification of French Railways.

For some time past the French State Railway authorities have been conducting electrification experiments on a stretch of the Western Railway, and it is stated that results have been so satisfactory that it has been decided to go into the matter on a larger scale. Contracts for 100 electric locomotives have just been placed with French and Belgian builders.

Another Volume of Annual Tables.

Vol. II of the "Annual Tables of Constants and Numerical Data, Chemical, Physical and Technological," edited and published by an International Commission created by the Seventh International Congress of Applied Chemistry and continued by the Eighth Congress, is now in press and will be issued about January 1, 1913. Vol. I, which was issued early this year, was sold to subscribers at $5.00 (unbound). The volume proved to be about 50 per cent larger than the Commission had anticipated. The second volume will have to be issued at a somewhat higher price, not yet fixed. Advance subscribers to the second volume will be entitled to receive the volume at the price at which it is issued to subscribers and will have the right to cancel their subscriptions within four weeks after the price is announced. Subscriptions should, therefore, be sent at once to Secretary of the Commission, Charles Marie, 9 Rue des Bagneux, Paris, France, or to the University of Chicago Press, Chicago. Payment of the subscription will be made to the University of Chicago Press when the volume is published. The price of the volume will be materially higher for non-subscribers, as only a limited number of copies beyond those subscribed for will be printed. Further information may be secured from the above addresses or from any one of the American Commissioners, Julius Stieglits, University of Chicago; E. C. Franklin, Bureau of Hygiene, Washington, D. C., and G. F. Hull, Dartmouth College, Hanover, N. H.

Van Dusen Rickert.

The Pennsylvania Electric Association in convention at Bedford Springs, Pa., by electing Van Dusen Rickert president for the ensuing year justly rewarded one of its most earnest and conscientious workers.

Mr. Rickert is a charter member of the Association and also one of the most popular members. He has twice held the office of secretary-treasurer and at the fourth annual convention at Conneaut Lake last September was elected vice-president, in which position he has been jointly responsible with President Orr, for the success which attended the latter's administration.

Van Dusen Rickert,
President of the Pennsylvania Electric Association.

Mr. Rickert hails from Pottsvile, where, as assistant manager of the Eastern Pennsylvania Railways Company he has made an enviable record as a central-station executive, being largely responsible for the gratifying lighting and power business which the company enjoys.

Van Dusen Rickert was born in Pottsville Pa., in 1869. He attended the public schools there, entering Princeton University in 1889, from which institution he was graduated from in 1892 with the degree of Civil Engineer. After graduation Mr. Rickert engaged in railroad contracting and later in the coal business. In 1900 he decided to enter the central-station business, accepting the position of manager with the Edison Electric Illuminating Company of Pottsville.

In 1906 a consolidation of railway and central-station interests in Schuylkill County was effected by J. G. White & Company, of New York, as the Eastern Pennsylvania Railways Company and Mr. Rickert made general agent. In this position he had charge of all matters relating to franchises, right-of-ways, etc., and also was in charge of the new-business department.

Mr. Rickert demonstrated such ability in this position that in March of 1912 he was made assistant general manager, in charge of the Pottsville central station. This position he still holds.

Effect of Previous Treatment Upon Core Losses.

At the meeting of the British Association for the Advancement of Science, at Dundee, Scotland, last month, a paper was presented by E. Wilson, B. C. Clayton and A. E. Power, entitled "On the Importance of Previous Magnetic History to the Engineer." Comparative measurements were made of the magnetizing current and core loss in a transformer and in different core materials after the core had been demagnetized and after it had been strongly magnetized by direct current in a definite direction. Curves are given showing the percentage difference in the two cases, the values always being larger after the core had been polarized strongly in one direction. These differences amount to as much as 75 per cent in magnetizing current and 45 per cent in watt loss for small values of the flux-density, and even for large values these reach 10 per cent.

Kentucky Underwriters' Inspection.

A special department for the inspection of wiring and electrical connections is to be established within the next sixty days by the Kentucky Actuarial Bureau, of Louisville, Ky. The Bureau handles rates throughout the state for the stock fire insurance companies. Manager Clem E. Wheeler has decided that electrical inspection is so important in this connection that the work cannot be handled acceptably merely as an incidental in the routine of the Bureau. He, accordingly, is employing additional inspectors and will have the new bureau in operation soon.

Tests of Tungsten Lamps.

In the annual report of the Physikalisch-Technische Reichsanstalt, Berlin, Germany, showing the work done during the year 1911, special mention is made of a test upon four 400-Hefner, 110-volt lamps which had an initial consumption of 0.95 watt per horizontal international candle. After burning for 1,000 hours the specific consumption had gone up to 1.02 watt per candle, representing a decrease in candlepower of eight per cent. It is further stated that in Germany both 220-volt, 16-candlepower and 110-volt, 10-candlepower lamps are now on the market.

The Electric Railway Convention.

What was probably the largest and most enthusiastic convention of the American Electric Railway Association and its affiliated associations, was formally opened on the afternoon of Monday October 7, at the Saddle and Sirloin Club, Union Stock Yards, Chicago. The Monday afternoon sessions included meetings of the Engineering Association, the Transportation and Traffic Association, the Accountants' Association, and the Claim Agents' Association. Monday morning, and practically all of the first day, was given over to registration and the distribution of badges. Tuesday morning sessions were held by the Accountants, the Engineering Association, Transportation and Traffic Association, and the Claim Agents' Association. On Tuesday afternoon the first session of the American Association was called to order at 2:30 o'clock. On Wednesday morning meetings were held by the Accountants, the Transportation and Traffic Association, the Engineering Association, and the Claim Agents' Association. The afternoon of Wednesday was devoted to the second meeting of the American Association. On Thursday morning the Accountants and the Engineering Association held a joint session, followed later by a regular session of the Accountants' Association. The Engineering Association also held its regular session. A joint session was also held by the Claim Agents and the Transportation and Traffic Association, followed by a general session of both of these divisions. Thursday afternoon was devoted to a meeting of the American Association. On Friday morning the Engineering Association held its last session.

All of the meetings of the American Association were open and the arrangements for holding only the session of the American Association in the afternoon made it possible for all of the affiliated associations to attend the meetings of the parent organization.

The annual reception was held in the Gold Room of the Congress Hotel on Monday evening. The reception was followed by music and refreshments and informal dancing.

The entertainment program included a recital and vaudeville for the ladies in the ballroom of the Blackstone Hotel on Tuesday afternoon, a card party for ladies and gentlemen on Tuesday evening, an automobile trip over the park system with afternoon tea at the South Shore Country Club on Wednesday afternoon, and on Thursday evening a grand ball was given in the Gold Room of the Congress Hotel, with buffet refreshments.

The annual meeting of the Manufacturers' Association was held on Wednesday afternoon at the Saddle and Sirloin Club.

The exhibit space laid out in the grand amphitheater at Dexter Pavilion was complete in every detail and afforded the delegates and guests a splendid opportunity for a close survey of developments in electric railway material. The exhibits were extensive and very comprehensive, and included notable displays by Westinghouse Electric & Manufacturing Company, General Electric Company, Albert & J. M. Anderson Manufacturing Company, Allis-Chalmers Company, American Steel & Wire Company, Archbold-Brady Company, Corliss Carbon Company, Consolidated Car Heating Company, Crouse-Hinds Company, Central Electric Company, Duplex Metals Company, Joseph Dixon Crucible Company, D. & W. Fuse Company, Dearborn Drug & Chemical Company, Electric Service Supplies Company, Esterline Company, O. M. Edwards Company, Harrison Safety Boiler Works, W. J. Jeandron, H. W. Johns-Manville Company, Lyon Metallic Manufacturing Company, Massachusetts Chemical Company, National Carbon Company, Ohio Brass Company, Pyrene Manufacturing Company, John A. Roeblings' Sons Company, Rail Joint Company, Speer Carbon Company, Standard Underground Cable Company, Sterling Varnish Company, Standard Paint Company, United States Metal and Manufacturing Company. The Waclark Wire Company, Western Electric Company, and Yale & Towne Manufacturing Company.

A detailed report of the proceedings of the various associations and full descriptions of the exhibits of the electrical manufacturers will be published in the next issue.

Power Development at Syracuse.

The Niagara, Lockport and Ontario Power Company is operating its transmission system at full capacity, 60,000 horsepower, and cannot secure additional power from Niagara. In order to provide for the increasing demand for power at Syracuse, it will develop a hydroelectric project on the Salmon River, a subsidiary company, the Salmon River Power Company, having been organized for this purpose.

The supplementing of Niagara power with the Salmon River power will, the company asserts, not only give it opportunity to increase its business in Buffalo and the territory between Buffalo and Syracuse, but by the supplemental power from the Salmon River district give very much more satisfactory service in the Syracuse district, reduce to a minimum power interruptions, and help out in steadying its entire long-distance transmission system. The Niagara, Lockport & Ontario Power Company has contracts with lighting and railroad companies in and about Syracuse which operate 160 miles of electric railway as well as lighting Syracuse, Auburn and the territory served by the Oswego River Power Transmission Company. Deliveries to these companies have increased from 7,143 average horsepower per month in 1908 to 17,911 horsepower per month in 1912.

The Salmon River Power Company owns approximately 8,000 acres of land situated about 42 miles northeast of Syracuse, including the river bed of the Salmon River, for a distance of approximately 12 miles, in which distance the river has a fall of 330 feet.

New York Electrical Show.

The Electrical Exposition and Automobile Show, held at the new Grand Central Palace, New York City, was formally opened on Wednesday evening, October 9. The exposition will run continuously until October 19. Preceding the opening of the exposition, a luncheon was tendered to Thomas A. Edison by the New York Edison Company. Each exhibitor received an invitation, and after the luncheon a private view was tendered to all of the guests, including many prominent men in electrical, financial and industrial circles, and representatives of the general and technical press.

At the luncheon an original poem on Edison by William J. Lambton was read by Robert Lorraine, the actor. John W. Lieb, Jr., presided, speaking at some length of Mr. Edison's work, and of the 30 year's history of the New York Edison Company. Samuel Insull, president of the Commonwealth Edison Company, Chicago, responded in behalf of Mr. Edison. Among those present were Charles A. Coffin, H. M. Byllesby, Admiral Bradley A. Fiske, Frank L. Dyer, Charles L. Edgar, W. C. L. Eglin, W. W. Freeman, Frank W. Frueauff, A. W. Burchard, W. J. Hammer, Frank S. Hastings, John W. Howell, Dr. Alexander C. Humphreys, Charles R. Huntley, Samuel Insull, Edward H. Johnson, Charles Kirchoff, Charles W. Price, Thomas A. Edison, J. W. Lieb, Jr., Max Lowenthal, T. Commerford Martin, William D. Macquestion, W. H. Meadowcroft, D. McFarlane Moore, Thomas E. Murray, A. A. Pope, Calvin W. Rice, E. E. Rice, Jr., F. S. Terry, Fred A. Scheffler, Robert M. Searle, Don C. Seitz, M. S. Seelman, Jr., John A. Sleicher, Frank J. Sprague, B. G. Tremaine, F. M. Tait, Albert Taylor, Nikola Tesla, J. Robert Crouse, Dr. S. S. Wheeler, W. R. Willcox, Arthur Williams.

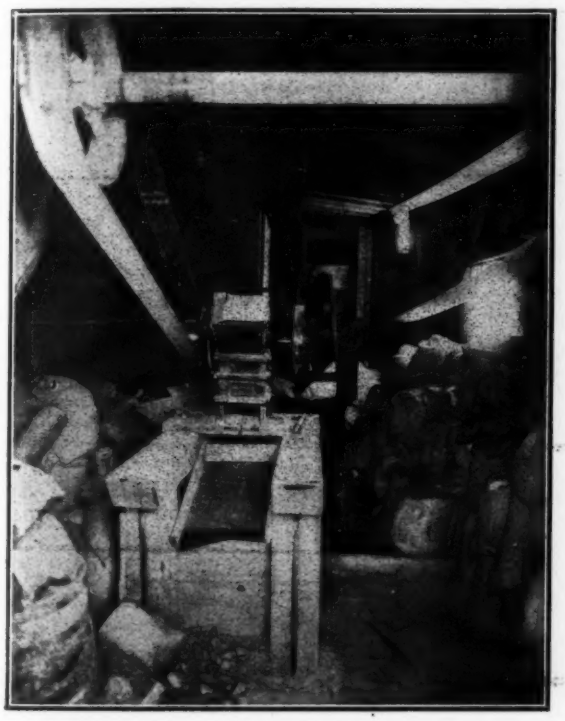
The exhibits this year exceed those of any previous year by more than 25 per cent.

Electricity in Plaster and Lime Plants.

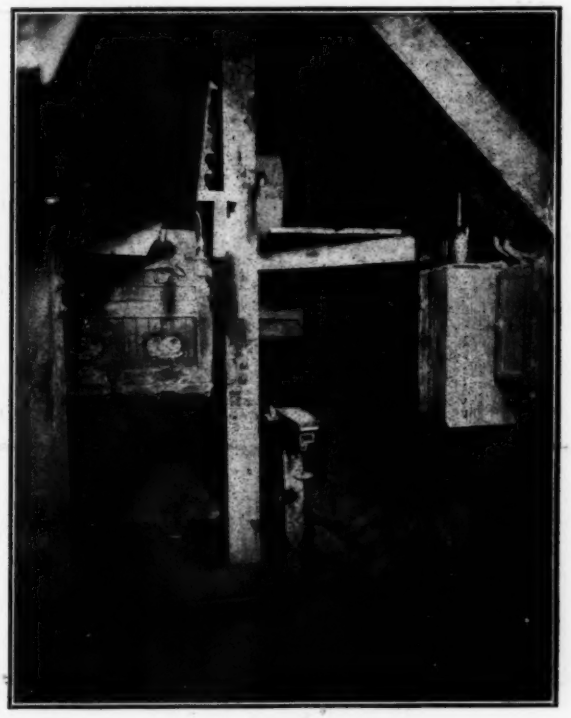
Motor drive in plaster-mixing plants and lime kilns and quarries eliminates the excessive cost of belt and shafting maintenance caused by the gritty dust in such plants and provides a more flexible, reliable and economical drive. Data are given in this article on four typical plants using central-station service.

While, commercially, the production of lime and the production of plaster have no connection, mechanically the operations, especially in the early stages of production, such as quarrying, crushing and pulverizing, are similar and the conditions relative to motor drive that apply in one case apply equally in the other.

A brief resumé of the processes of manufacture at this point will give one a better understanding of the duties the various motors are called upon to perform. One of the principal ingredients of plaster is plaster of paris, which in its crude state is gypsum, or hydrous sulphate of calcium. This gypsum is quarried or mined in a manner similar to the processes used in quarrying limestone. Blast holes are bored around the edge of the quarry pit by means of motor-driven air compressors. The stone loosened by the blast is loaded into cars and conveyed to crushers where it is crushed to the size desired, in the case of gypsum to about the size of an egg. After being crushed the gypsum is thoroughly dried by means of hot air being blown over it and is then pulverized, by means of motor-driven grinders. The pulverized gypsum is then calcined or boiled to remove the water which it contains and the resultant product is called plaster of paris. During the last process, boiling, the gypsum is constantly agitated by means of motor-driven paddles.



Motor Driving Crusher and Belt Conveyor.



Motor-Driven Mixer.

From the quarry plants, as above described, the plaster of paris is shipped to mixing plants were the other ingredients contained in plaster are added to the plaster of paris.

Wall plaster for both interior and exterior use is made up usually of plaster of paris, cement, prepared sand, and hair. In special brands of plaster other materials are used and in every case the amounts of the various materials depend upon the formula adopted by the manufacturer. In the mixing plants these materials are elevated to hoppers, usually located at the highest point in the building, and are emptied into large motor-driven mixers, automatically in the quantities desired. With the exception of rotary dryers for drying sand, the mixers and various belt, bucket and screw conveyors and hoists are the only machines used in mixing plants.

In the lime industry, the limestone is quarried, crushed, burned and either sold in lump form or pulverized. In this industry all work is done at the quarry and while all quarries should and from present indications will eventually use electric power, comparatively few are located in reach of central-station service. In the plaster industry, however, mixing may be considered as a separate industry as mixing plants are commonly located in towns and cities, plaster of paris being purchased from the quarry plants and shipped ready for mixing. Although a great many mixing plants are at present using central-station service there is still a large and profitable field for the central station in this industry.

Electric drive in plaster or lime works has the same advantages that have been demonstrated in so many other lines of work. Of particular importance are the advantages of flexibility and economy, and, the elimination of belting and shafting is specially desirable in a lime or plaster establishment where the gritty dust makes the maintenance of both belts and bearings expensive.

Although direct-current has been used in a few cases, the present practice is to use alternating-current motors, almost exclusively, in plaster and lime plants and all modern establishments are being so equipped. The polyphase induction motor has many advantages, not the least of which is the absence of commutator and brushes. The cost of maintenance is less than for direct-current machines, and in the dusty atmosphere of a plaster mill, the simple squirrel-cage rotor of an induction motor is much less liable to give trouble than the wound armature of a direct-current machine.

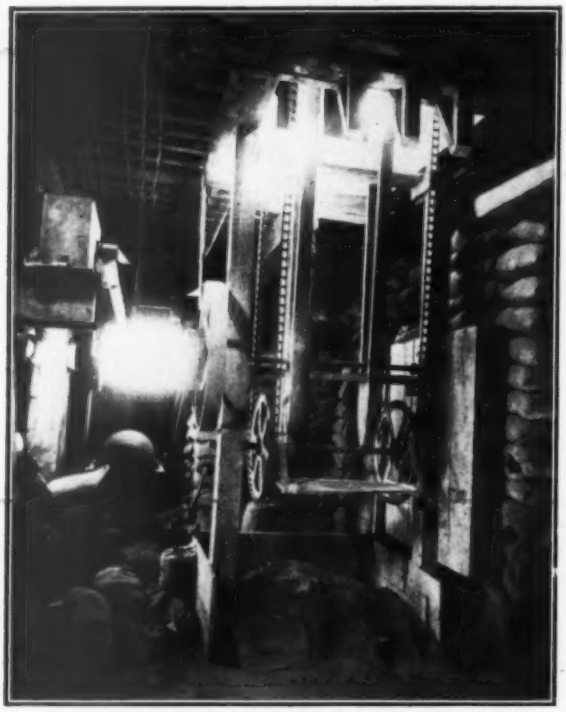
At the quarry for operating crushers where the crushers are to be operated by individual motors, all such motors should be of the slip-ring or wound-rotor type, from a 15-horsepower motor driving a No. 3 crusher, upwards. Slip-ring motors have a very much stronger starting torque than do the squirrel-cage type of motors and in case crushers are accidentally or intentionally shut down when full of rock it is often possible, by backing the belt up six or eight feet, to start the crusher with a slip-ring motor, without cleaning out all of the rock as it is necessary to do if a squirrel-cage motor is used. This feature will at times save from 15 minutes to two hours' time in the operation of the crusher plant. Along these lines it is recommended that belts to crushers be of the highest grade and amply large so as to stand undue strain or slippage under such extreme starting conditions. It is strongly advised that all motors be equipped with dustproof bearings.

As with crushers, the use of slip-ring motors is advised on bucket elevators, where the elevators are of comparatively large size and driven by individual motors. At times when the elevator boot becomes filled with rock, due to some stoppage of the elevator, it is possible to start same more slowly, with more power and under better control with the multiple point starting apparatus of the slip-ring motor than with the two-point starting apparatus of the squirrel-cage motor. Slip-ring motors are also desirable for operating rotary kilns where a variation in speed is sometimes desirable; and also for electric hoists; but for practically all other classes of work constant-speed squirrel-cage motors are preferred.

Probably the most severe service in a plaster or lime plant is that demanded of motors for running ball and tube mills used for grinding the raw material. Tube mills are difficult to start, as the whole mass has to be swung up until the first half revolution has been made. This demands heavy starting torque, usually amounting to 1.5 to 2 times full-load torque. It is desirable, therefore, to use for these mills a motor having torque higher than for ordinary service. If this is not done, the motor will take an excessive current at starting, or if the voltage drops to any great extent, the motor may even fail to start the mill at all. Motors for this service must be of liberal size to give the requisite starting torque and also operate continuously at full load in a dusty atmosphere, without undue rise in temperature. It must be remembered that in plaster mills the fine dust gets into the ventilating passages in the motor, and they may in time become clogged up, thus materially increasing the temperature rise.

The starting apparatus used with these motors must also be of liberal design in order to carry heavy starting currents. Sometimes the mills are started by throwing the current off and on, giving them two or three swings until they finally turn over. This is especially hard on the starter and should not be necessary if the motor has ample starting torque. All starters should have oil immersed switches for changing the connections from "starting" to "running," and transformers provided so that a reduced voltage can be applied to the motor at starting, thus reducing the current taken from the line. For this severe starting service, where the motors are frequently operated by an unskilled class of help, the starters can be fitted with a device that prevents

(Continued on page 683.)



Motor-Driven Sack Elevator.

Motor-Driven Mixer.

Plaster and Lime Plants—Data Sheet No. 1.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Garden City Sand Company, Chicago, Ill. This company operates a separate plaster manufacturing plant at which various grades of plaster, for interior and exterior use, are manufactured. The average daily output is 800 bags of plaster, each bag containing 100 pounds. Nine men are employed, working 10 hours per day.

Total connected horsepower, 63.5. Total number of motors installed, 8. Average kilowatt-hours per month, 1,474.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
August	1,670	December	746	April	1,000
September	1,730	January	946	May	1,273
October	1,727	February	2,161	June	1,764
November	1,206	March	1,763	July	1,704

Load-factor, 4.2 per cent; operating-time load-factor, 12 per cent.

The approximate electrical energy consumption per ton of plaster manufactured is 1.4 kilowatt-hours.

Motor Installation

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60-cycles, 220 volts. All motors are of the squirrel-cage induction type.

No.	Horse-power.	Speed R. P. M.	Application
2	10	1,200	Each belted direct to an 800-pound Broughton plaster mixer, manufactured by W. D. Dunning. Each mixer has 64 blades and has a capacity of 30 tons per day.
1	5	1,200	Belted direct to a 48-inch exhaust fan which collects dust in a dust collector.
2	7.5	1,200	Each belted to a bucket conveyor for raising sand from boats to top of building. Capacity 40 tons per day each.
1	7.5	1,200	Belted to a line shaft driving one rotary dryer; and one small air pump.
1	1	900	Belted direct to mechanism of sack hoist.
1	15	900	Belted to line shaft driving belt conveyor, 585 feet long; and one small Universal quartz crusher.

Energy is supplied by the Commonwealth Edison Company.

Plaster manufacturer producing a good grade of wall plaster, the raw materials for which are plaster of paris, cement, picked hair, prepared sand and shredded asbestos. The plant has a capacity of 30 to 50 tons of plaster per day. Fifteen men are employed working ten hours per day.

Total connected horsepower, 33. Total number of motors installed, 3. Average kilowatt-hours per month, 1,540.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
April	1,517	August	1,416	December	1,275
May	1,363	September	1,188	January	1,642
June	1,502	October	1,276	February	2,123
July	1,205	November	1,636	March	2,345

Load-factor, 8.5 per cent; operating-time load-factor, 23.8 per cent.

The approximate electrical energy consumed per ton of plaster made is 1.3 kilowatt-hours.

Motor Installation

The following is a list of the motors installed with their respective drives. The supply source is two-phase, 60 cycles, 200 volts. All motors are of the squirrel-cage induction type.

No.	Horse-power.	Speed R. P. M.	Application
1	15	1,120	Belted to 36-foot shaft, 140 revolutions per minute (seven hangers) and four countershafts (nine hangers), driving one American Process Company rotary dryer, 16 revolutions per minute, 16.5 feet by 4 feet diameter; one No. 3, 16-inch Buffalo blower, 4-inch driven pulley; one 6-inch wide bucket conveyor; one 30-foot vertical bucket conveyor; one 50-foot vertical bucket conveyor.
1	15	1,120	Belted to approximately 15-foot shaft, 152 revolutions per minute (three hangers), driving one 30-inch diameter by 3.25-inch grindstone; one Broughton mixer, 24 inches diameter driven pulley; one hair picker, 730 revolutions per minute, 5 inches diameter driven pulley.
1	3	1,200	Belted to 10-foot shaft, 154 revolutions per minute (two hangers), driving one conveyor to lift bailed material from track level, 30-degree lift.

Plaster and Lime Plants—Data Sheet No. 2.

Lime plant quarrying lime stone which is burned, producing approximately 200 tons of lime per day. Of this output 80 tons are pulverized, the remainder being sold in the lump form. About 240 men are employed.

Total connected horsepower, 460. Total number of motors installed, 15. Average kilowatt-hours per month, 36,966.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
July	32,000	November	42,000	March	42,800
August	29,100	December	38,200	April	42,700
September	27,000	January	39,800	May	31,900
October	39,800	February	29,000	June	39,300

Load-factor, 14.7 per cent.

The electrical energy consumed per ton of lime produced is 7.2 kilowatt-hours.

Motor Installation

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power.	Speed R. P. M.	Application
2	37	580	Slip-ring motors each geared to a drum hoist used for hauling two cars up a 400-foot 10-degree incline.
1	37	580	Slip-ring motor geared to drum hoist used for hauling one car up a 200-foot 23-degree incline.
1	37	580	Slip-ring motor geared to drum hoist used for hauling two cars up a 1,000-foot 5-degree incline.
1	30	1,120	Belted to a 125-foot shaft driving six Sturtevant No. 6 blowers at 1,400 revolutions per minute. Each supplies air to a coal-fired kiln.
1	10	1,700	Direct-connected to a Worthington two-inch two-stage turbine pump, total head 75 feet.
1	25	850	Direct-connected to a Worthington six-inch volute pump, head 45 feet.
1	30	850	Belted to the flywheel of a Sturtevant jaw crusher. A 10-inch by 15-foot bucket elevator is belted from crusher.
1	40	850	Belted to 400-foot 30-hanger shaft driving five American No. 7 blowers; two Sturtevant No. 6 blowers, and five Sturtevant No. 5 blowers.
1	25	850	Belted to a Sturtevant No. 3 gyratory crusher, crushing 13.5 tons of lime per hour.
1	5	850	Belted to a 12-inch by 100-foot belt conveyor, 30-foot lift.
1	50	850	Belted to a 10-foot shaft and 43 feet of countershafting driving one pulverizer, two burr stones 40 by 12 inches; one 12-inch by 40-foot bucket elevator; one 4 by 9-foot vibrating screen; one Invincible sack packer; one Bates five-spout bag packer; one 12-inch by 40-foot bucket elevator; one 10-inch by 30-foot screw conveyor; one Jeffrey slanting flat screen; and one 12-inch by 18-foot elevator.
1	37	580	Slip-ring motor geared to a drum hoist used for hauling cars up a 300-foot 18-degree incline.
1	30	1,120	Direct-connected to a Worthington 5-inch turbine pump.
1	30	850	Belted to a 20-foot line shaft driving one Sturtevant No. 5 blower, 1,000 revolutions per minute; one E. & B. Holmes barrel tresser driven by two belts, used for pressing steel hoops on barrels; one Holmes barrel raiser for drawing in ends of staves so that steel hoops can be loosely placed on barrels; one Holmes No. 33½ crozer used for cutting ridges in end of assembled staves to receive barrel head; one Ideal hooping-off and heading-up machine; one Buffalo No. 2 blower, attached to above machine; one Holmes punch press for riveting steel hoops, flywheel 46 inches diameter; one William Gladner hoop expander, 72 expansions per minute; and one 12-inch by 30-inch belt conveyor inclined at 30 degrees.

All motors, except those indicated, are of the squirrel-cage type.

Fowler & Pay, Mankato, Minn., lime kiln. Group drive. Running hours per week varies.

One 10-horsepower squirrel-cage induction motor is installed. Average kilowatt-hours per month, 1,313.

Kilowatt-hour consumption for six months: April, 1,384; May, 1,303; June, 1,325; July, 1,216; August, 1,397; September, 1,256.

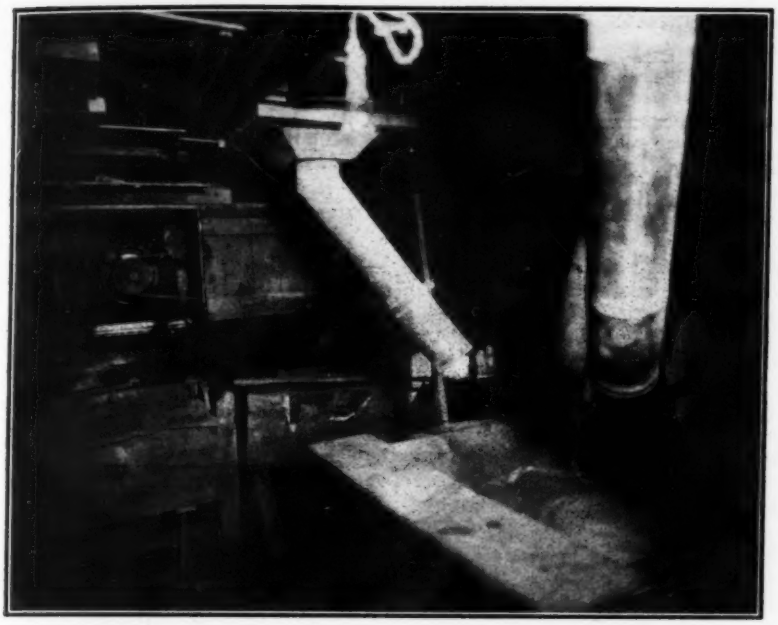
Load-factor, 24.1 per cent.

Motor Installation

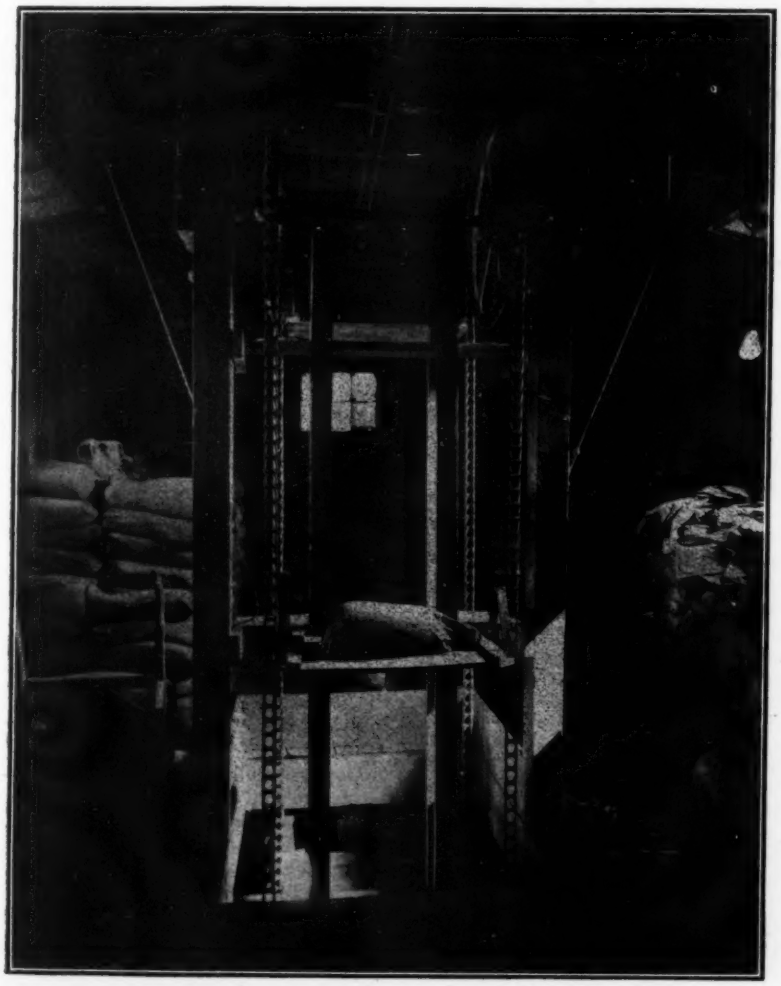
The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power.	Speed, R. P. M.	Application
1	10	1,800	Belted to a line shaft driving one 36-inch double Sturtevant blower, supplying air to lime kiln; and one pulverizer, having two burr stones 40 inches by 12 inches.

Energy for this installation is supplied by the Consumers Power Company.



Motor Operating Bucket Conveyors Emptying Into Mixer Hopper.



Sack Conveyor Driven by 5-Horsepower Motor.

the handle from being left on a starting position; if left on a starting position it at once returns to the off position, thereby preventing a burnout of the starter.

Motors for operating these mills are usually belted and run at moderate or slow speed. On 60 cycles, 50-horsepower motors running at approximately 850 revolutions per minute full load have been used for ball mills but a slower speed motor is more desirable and 670-revolutions-per-minute machines are now recommended. On 25 cycles, four-pole motors running at approximately 700 revolutions per minute full load are used.

For 5 by 22-foot tube mills a 75-horsepower motor running at 670 full load on 60 cycles is suitable, while on 25 cycles speeds of 700 revolutions per minute or 470 revolutions per minute are available, the latter being preferred. Motors are belted directly to the main driving shaft on the mill from which the latter is driven through spur gearings.

The foregoing discussion applies to conditions in lime and gypsum quarries and crushing plants. Additional data on this subject can be obtained from the article entitled "Electricity in Stone Quarries and Gravel Pits," which appeared in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for March 30, 1912. In mixing plants where the various ingredients used in plaster are mixed into the finished product, the principal mechanical operations are raising the incoming materials to their respective bins, mixing, and in some cases operating rotary kilns for drying sand, etc. Miscellaneous blowers, pumps and elevators are also commonly found in such plants.

In mixing plants as in quarries and mills, the predominating advantages of motor drive are economy, flexibility and the elimination of belting and shafting. When central-station power is purchased it is possible to handle incoming materials by means of bucket, belt or screw conveyors without having the entire plant in operation. Very few machines are in actual service more than half of the time, and the cessation of all energy losses chargeable to each machine, except while it is in productive operation, constitutes a very large saving in power.

In soliciting the adoption of central-station power for mixing plants, the power solicitor, in the majority of cases has to contend with a present steam plant and must convince the owner that electric drive with energy purchased from the central station will not only mean a saving but a saving sufficient to permit of scrap-

ping the present steam plant—which course is almost universally necessary.

The steam plant of a mixing plant is, in the vast majority of cases, an exceptionally inefficient one, operating under adverse conditions and with great losses. The buildings are more or less temporary and in their construction practically no attention is given to such items as economy in handling fuel and ashes, draft for furnaces, steam piping, etc. Machinery is usually of an inexpensive and inefficient character and as a result enormous amounts must continually be spent for repairs and renewals. Trouble is also being encountered with boilers.

When these conditions are figured on a basis of dollars and cents, and then compared with the cost of equipping the plant with motors and the operating costs with electric drive it certainly should not be difficult for central stations to secure this business.

A mixing plant that may be considered typical of the establishments usually located in cities is that of the Garden City Sand Company, of Chicago. This plant has an average output of 800 bags of plaster per day, each bag containing 100 pounds. Nine men are employed working 10 hours per day. Energy is purchased from the Commonwealth Edison Company, the average monthly consumption being 1,474 kilowatt-hours. The load-factor of the plant is 4.2 per cent.

To handle the present output 63.5 horsepower in squirrel-cage induction motors are installed. Raw materials are received at the plant by boat, rail and wagon. All such material is raised to the third floor of the plant where the various bins are located. Bucket conveyors handle practically all of the incoming products, 37.5 horsepower in motors being necessary to drive these. From the bins the various ingredients are dropped into the hoppers of the two Broughton plaster mixers, after first being automatically weighed. The mixers are each driven by a 10-horsepower squirrel-cage induction motor, running at 1,200 revolutions per minute, and each has a capacity of 800 pounds of plaster. The mixers extend from the second to the first floor, where the plaster is sacked and sealed ready for shipment. The dust which forms on this floor is collected by a 48-inch exhaust fan driven by a 5-horsepower motor running at 1,200 revolutions per minute.

Sand, before it is stored in the overhead bins must first be thoroughly dried and therefore passes through a rotary dryer, driven by a 7.5-horsepower squirrel-cage motor. This motor also operates a small air pump. Information relative to other mixing plants and lime kilns and quarries is given in the accompanying data sheets.

Commercial Practice
Management, Rates, New Business

RELATIVE VALUE OF THE COMMERCIAL DEPARTMENT IN CENTRAL-STATION SERVICE.[1]

By A. F. Douglas.[2]

The commercial department of central stations has been given a great deal of thought and consideration of late years. This is due largely to the fact that this department, through the institution of modern commercial methods has brought about the most broadening influence which this industry has felt in its history. Just as soon as central-station managers made up their minds to persuade more people to use their service and to persuade consumers to use more service, genuine improvement of the service began. The conservative and judicious lowering of prices began and the study of correct public relations for the first time began to receive the attention it deserved.

The commercial department of proper training studies the public wants and sees that the public gets service to suit its tastes and demands. This is precisely what is doing more today than anything else to make favorable public sentiment for public-utility corporations.

All of the good-will advertising that can be published would not itself make good service, reasonable rates or courteous employees. However, it is true that in many cases the self study entailed by a utility company which contemplates advertising of one kind or another has often awakened that company to its own shortcomings. It is also true in many cases where such a company has established a good, live commercial department, the salesmen soon discovered that the company was not able to offer the right kind of service to obtain additional revenue and by investigation and analysis convinced the management that rejuvenation of property and methods was essential.

Men of large caliber are in demand today for commercial work in central stations. Large salaries are being paid and good talent is scarce. Some of the companies have devoted money and time to the training of men for commercial work for representatives in this department, which today requires special education and training to enable the men to reach their full efficiency. If a commercial-department representative has a thorough technical training plus the quality of salesmanship, he is all the more a valuable man because he has that training; however, besides technical training and the ability to sell, he must acquire a vast amount of special information pertaining to the central-station business which he can only obtain by specific instruction and experience.

There never has been a time in the history of the central-station business when general managers for operating companies were in such great demand. The heads of large companies and managing syndicates find it almost impossible to secure the right men to handle local operating properties. The salaries paid are large compared with other lines of endeavor, but the work is exceedingly difficult and only comparatively few men seem to possess all of the many faculties which are called into play in the exercise of such a position.

During the last few years it is safe to say the majority of new managers who are making conspicuous success have come from the channels of the commercial departments. In the minds of the leaders in the public-utility business this trend is going to prevail.

The commercial work and training appears to develop the men in many ways and to bring out not only their ability to sell but to grasp the entire

1 A paper read at the convention of the Northwest Electric Light and Power Association, Portland, Ore., September 11 to 14, 1912.

2 Assistant manager, new-business department, H. M. Byllesby & Company.

business in a comprehensive way, to overcome the difficulties which the industry meets with from day to day, and to exercise the initiative without which no man can become a success as a general manager. Whether or not the industry as a whole is prepared to admit it, representatives of the commercial department are becoming the right-hand men of the managers in a great majority of cities.

The manager finds that employees of his department are usually men who concentrate upon a single phase of the business over which he has to exercise his general supervision. The commercial department finds men who are interested in all phases of the industry, men who are constant students and who are always alert to learn every detail of the business. Such an attitude of investigation and interest cannot fail to establish a bond of sympathy with the manager; which bond of sympathy time and time again has worked in the promotion and advancement of the commercial-department representatives.

The commercial-department representatives should never lose sight of the fact that good citizenship and active participation in the affairs of the community in which they live are commendable and should redound to their own advantage and to the credit of the company which employs them. They should display an active interest in community affairs and if the occasion presents itself when their services can be put to use for the good of the city they should rise to the opportunity and do their best.

I have in mind a recent instance at a certain property where the chief of the commercial department attained an immense amount of publicity and praise, not only for himself but for his company, through his activities in connection with obtaining new members for the local chamber of commerce.

In addition to being good citizens and active in the best interests of the community, every employee of a public-utility company should inform himself as far as possible regarding the fundamental reasons which justify the existence of the industry from which he makes his living. He should read all literature which he can obtain on the subject of municipal ownership, rate regulation, regulation by state and local commissions, etc. He should endeavor to equip himself with the knowledge and facts to defend his industry against casual attacks and criticisms from individuals whom he may meet almost everywhere. A great many employees of public-utility companies never pay any attention to the matters referred to in this paragraph and by such neglect they omit to perform their full duty towards themselves and toward their employers. It is difficult, indeed, for a man to be enthusiastic about his work if he does not believe in the economic integrity of his business.

It is a matter of record that a number of Western central stations which for a great many years have been financial failures, today are numbered with the most successful companies, which success reflects directly upon the commercial department. The work of the commercial department has aroused the keenest interest and there is no doubt that the central-station industry is now being developed faster than at any time in its history, which, in a large measure, is due to the promotion of new devices and appliances for domestic and industrial use.

I think we are safe in saying that in recent years, the work of the commercial department has become the greatest factor in the success of the public-utility business. The value of this department as a business getter is no less than its value as a molder of public sentiment for the utility. A salesman reflects the character of the company he represents in every word and deed, and can do wonderful work in building up that invaluable asset of good will. The value of this intangible asset can be more fully appreciated when we observe that public service commissions are often capitalizing it as high as 30 per cent of the entire valuation of the property. It is as necessary to the ultimate success of the business as the machinery that generates the current in the power house.

It is frequently within the salesman's power to satisfactorily adjust a complaint or remove the antipathy arising from some real or imaginary grievance against the company. A pigeon-holed complaint or neglected request of a consumer, is no asset to the company. The contrast to this is that "a satisfied consumer is the company's best advertisement." A dissatisfied and complaining consumer often breeds discontent and ill will that may do the company irreparable damage. Selling service is only half the battle; producing a satisfied and enthusiastic consumer and maintaining that condition, is the other half. To be satisfied, a consumer must first appreciate that he is getting value received for every dollar paid to the company for service rendered, and it devolves upon the commercial department to convince him of this fact and keep him convinced. It has been well said by one of our commercial managers that "holding one old consumer is worth getting two new ones."

Personal contact with consumers creates a human interest in the utility company that the impersonal contact can never do. Unfortunately, in the layman's mind the public-service corporation submerges the personality of the individual comprising it. It is for the commercial representative to dispel that anti-corporation feeling by impressing the people with his own personality, and showing them that a corporation is merely a happy legal convenience for giving ready, effective and consistent expression to co-operative endeavor.

The commercial department men are doing much good in the organization of local associations of central-station employees. Meetings are held regularly to discuss subjects vital to the business, to promote good fellowship and become familiar with the art of public speaking and discussion. These clubs are far more valuable to the industry than they may appear from first thought and are deserving of the earnest support of every commercial department and every employee of a central station.

While the foregoing is quite enthusiastic in bringing out the real importance and dignity of the commercial-department work in the central-station industry, I think it would be well to call attention to the fact that commercial-department men should not for a moment get the idea that it constitutes an overwhelming portion of brains and importance of the central-station industry. It never can do all this, however, they should be the visible symbol of the company in the service of the public and must therefore represent all other departments, in fact, be an exponent in some manner in every phase of the industry.

The man who is making a career out of the commercial department should cultivate modesty as well as knowledge and to better serve his own interests should conduct himself so as to be on the friendliest possible terms with every other department and employee of the company.

Electrical Advertising

The following pertinent commentary on electrical advertising appearing in the current issue of *Signs of the Times* indicates to some extent the prominence which this form of publicity has attained. Unquestionably central stations are in a large measure responsible for the remarkable growth of this field.

Not only has electrical advertising taken its place in the family of recognized advertising media, but it has assumed a leading part and made its presence felt.

It is a most fortunate electric sign of the times, when many of the very biggest advertisers of the country adopt electrical advertising as one of their primary mediums and use it in a liberal, national manner.

Not only has the original "Great White Way" grown into a great advertisers' avenue, but every city in the country—large and small—now boasts of its own white way, and the public takes the keenest interest in the beautiful electric advertisements, readily considering them city beautifiers.

There is no secret about electric advertising. There never was any secret to the power of light. The first divine command was that there be light.

The promoters of a great exposition do not rely upon beautiful boulevards and symmetrical arrangement of parks to furnish publicity enthusiasm and inspiration to give the event the right "punch."

They turn on the lights; they use light, and plenty of it.

More and more are our cities becoming expositions. They are commercial centers where the advertisers of the world exhibit their wares that all the world may know of them. Our cities are expositions of business and they must have light. The "Great White Way" is the solution.

Stands for Cooking on Inverted Electric Irons.

The Marion Light & Heating Company, Marion, Ind., recently distributed among its customers who have electric irons, 400 little stands for holding the irons in an inverted position for cooking, heating water, etc. The holders were simply and substantially constructed of three-eighths inch by one-sixteenth inch iron, securely riveted and painted with aluminum bronze. In lots of 100 they cost 15 cents each, but they were given away by the central station to any customer owning an iron who called and asked for a holder. The holders fit any kind of electric iron and adapt the upturned heating surface for warming water, cooking eggs, boiling coffee, warming baby's milk, etc. With no other device than the electric iron in the house, a fair breakfast can be prepared in a few minutes, the inverted iron making, it is declared, especially fine coffee. The holder is also useful for other household operations, such as steaming velvet, etc. S. H. Smith. local manager, checked the consumptions of several customers who employed these holders to amplify the uses of their electric irons, and found that those compared had each increased consumption by about 15 cents' worth, so that the little stands paid for themselves the first month.

Trade-Marking "Service."

An attractive trade-mark with which St. Louisans are to be made as familiar as they are now with the equestrical figure of the city's patron saint, Louis IX, has been adopted by the Union Electric Light & Power Company for use on all its stationery and in all its advertising regarding its reduced rates for electricity.

This trade-mark emblemizes the company's contributions to the welfare, comfort and progress of St. Louis—light, power, heat and service, not the least of which is the last. The magnet, which is the most conspicuous feature of the trademark, typifies power and the sun light and heat. Between and outside the poles of the magnet—the positive on the left and the negative on the right—appear the lines of force represented by dots. These symbolize the electric energy which is furnished by the Union company. From the sun radiate rays of light and warmth—just as from electricity both illumination and heat may be derived.

Service, in the significance which the word has acquired in respect to the furnishing of light, power and heat, means more than the mere production and sale of those commodities. It embraces also suggests advice, attendance, assistance. Merely to conduct electric current to a customer's home, office or factory is the beginning of service. Its application to his needs for light, power or heat so as to combine the highest efficiency with the lowest cost, is the true and complete fulfillment of service.

That electric power may increase output and reduce expense in industrial plants; that electric light illumination may be something more than a haphazard glowing of lamps, and electric heating something else than an exchange of an old for a new method, the central station must co-operate with the consumer to see that his wiring machinery, appliances and practices are such as science and experience approve.

Increasing Store Lighting Business.

"There are many ways of increasing the revenue the lighting company derives from stores," says Manager H. E. Morton of the Albany (Ore.) Power Company. "These methods should not be neglected by the solicitor merely because the store is already using light, for it will be found that by a call the solicitor can interest the consumer in window lighting, sign lighting, coffee mills, refrigeration, fans in summer, etc.

"By persistence, even in a small town, a large amount of window and sign lighting may be secured on a flat rate by including the cost of the installation in the contract so that a small amount is paid each month covering the duration of the contract. The contract, however, should not be for less than one year. By securing this business on a flat-rate contract there is no danger of losing the revenue, which might be the case if the consumer were served by meter for the reason that if business happened to be poor the merchant could cut off lights."

Believes in Advertising its Service.

The Sandusky Gas & Electric Company, Sandusky, Ohio, is advertising its service with a large electric roof sign 28 feet long and 16.5 feet high, with letters ranging in height from 16 inches in the top row to 20 inches in the second row and 18 inches in the bottom row. The operation is as follows: First, the words, "Use Electric Light and Power" appear, with the figure of a girl, who next throws a switch displaying the upper border and a lamp outline at the top. Then she turns another switch, starting in motion the belt and pulleys at the bottom, typifying electric power.

There are 190 lamps in the large lamp outline at the top, 180 lamps in the letters and 391 in the other features, all of the 5-watt, 11-volt tungsten-filament type. The Sandusky company has received numerous compliments on this sign and is very much gratified over the results. The design was worked out by the builders from suggestions contributed by E. A. Bechstein, manager of the Sandusky company.

Wireless Between Norway and United States.

The director of the State Telegraph of Norway has closed a contract with the Marconi Wireless Telegraph Company, subject to the approval of the Norwegian Government and Storthing, for constructing and operating a wireless telegraph service between Norway and the United States. While New York or its immediate neighborhood has been selected for the American station, it has not yet been decided where the Norwegian station will be placed, though several places on the west coast have been spoken of, as well as the Tryvand Hill near Christiania. It will be one of the largest, if not the largest, wireless station in the world, and Norway has been chosen because the line can run direct without passing over any other country.

Private Central Stations.

Following action which it took nearly a year ago in deciding that a number of central stations, privately owned, existed and operated without franchises in Louisville, Ky., the Board of Public Works in that city has notified several owners of lighting and power plants that they must secure franchises or cease serving consumers across streets and alleyways. Two of these concerns have agreed to apply for the necessary license by November 1 and the others have been instructed to cease trespassing upon public property before that time.

Electrical Construction

DIRECT - CURRENT - MOTOR FIELD COILS.[1]

By R. B. Treat.

The output of a direct-current motor is the product of torque and speed.

Torque is proportional to the effective magnetic field, number of armature conductors, and amperes to the armature.

Speed is proportional to the volts supplied to the motor (less the resistance volts drop), and inversely proportional to the number of armature conductors, and the effective magnetic field.

There are three characteristic types of field-coil windings all applicable to to one armature, but each giving different characteristics to the torque and speed of the motor. Also commutating poles may be added to the motor, giving it another set of characteristics.

Consider first a shunt motor without commutating poles. A shunt motor rotating in one direction will have for best commutation a different brush position for each different load current. At no-load the brush position will be at "the no-load neutral," and for each increase of load current the best brush position is removed from the no-load neutral in a direction opposite to the armature rotation.

With brushes at the no-load neutral a current in the armature conductors sets up a magnetic field which strengthens the leading pole tip—the pole tip in advance of the brush in the direction of rotation—and weakens the trailing pole tip. This is called the distorting field. The effect is to shift the neutral position toward the weaker pole tip, in a direction opposite to the armature rotation, and at the same time slightly weaken the main field.

An explanation of the distorting field causing the main field to be slightly weakened lies in the fact that the distorting excitation is uniformly distributed under the entire pole face; half of this excitation is aiding the main field and the other half opposing. The magnetic density in the teeth under the pole is such that in half the teeth the opposing excitation causes a greater decrease of the magnetism than does the same amount of increased excitation cause an increase of magnetism.

Shifting the brushes into the new neutral is not quite sufficient, because each load current requires a proportionate amount of assistance from the main field for sparkless commutation. The shift must therefore continue a little further than the newly found neutral, shifting still more into the weak-pole-tip region.

The armature conductors included between the no-load neutral and the new brush position set up a magnetic field which is in opposition to the main field and which reduces its strength. (Demagnetizes it.) It is impractical to move the brushes for each change of load current, so it becomes necessary to select a brush position such as will cause the sparking and the wear on the commutator to be a minimum.

The effective field is shown to decrease with an increase of armature current; consequently the torque does not increase in proportion to the armature current.

The speed tends to decrease as the load increases because of the armature resistance decreasing the effective voltage at the armature, and tends to increase with load because of the decreased field. The resultant of the two actions is to let the speed decrease only a little or may be to keep the speed about constant. If the motor is of such design as to permit considerable variation of the main field by small changes of the shunt excitation (a short air gap), then with load increase it may happen that the "blowing out" of the field will more than counteract the effect of armature resistance and the speed will increase with load.

A reversing shunt motor will have its brushes set at the no-load neutral. The load current in the armature will only distort the field, causing a field of the incorrect polarity to be present at the brush position, and requiring the brushes to carry all the burden of commutating the load current. The main field will be only slightly reduced by the distorting action. The torque will be nearly proportional to the load current and the speed will decrease because of the armature resistance.

A compound motor of one-way rotation will have its field strength automatically increased with increase of armature current. The stronger field due to increased load will not be so greatly distorted as in a shunt motor and the brushes need not be shifted so far. The demagnetizing action then becomes less than in a shunt motor, which again relieves the necessity for so much brush shift. The resultant effective field will remain nearly constant and the torque will be in proportion to the armature current. The speed will decrease with load increase because of the combined armature and series resistance reducing the effective armature voltage.

A reversing compound motor with increasing load will also have automatically increasing field but with less distorting action from the armature and no demagnetizing action. The brushes will be better able than in a reversing shunt motor to commutate the load current because of the more rigid field, distortion being less. The torque will increase a little more rapidly than the load current and the speed will decrease more than in any of the previously discussed designs.

A field-weakening motor for obtaining various desired speeds may or may not have a series winding in addition to the shunt winding. At the higher speeds the motor has very exaggerated characteristics of the shunt motor, and if the load current varies greatly it often becomes necessary to have a series winding to prevent the field from being entirely "blown out" by the armature.

A reversing series motor has its field excitation always in proportion to the armature current. The field strength is roughly proportional to armature current up to three-quarter rated load at which point the saturation of the magnetic circuit commences to become prominent and thereafter with increase of armature current the field increases to a less degree until finally it has reached saturation when no appreciable field change will result from increased armature current.

The distorting effect of the armature upon the field only becomes of consequence at near full load and above, at which time it may even cause a decrease of field with heavy overloads, because no more magnetism can be gotten through the frame, while the

[1] A paper presented at the annual convention of the Association of Iron and Steel Electrical Engineers, Milwaukee, Wis., October 1, 1912.

distorting excitation of the armature causes the magnetism to decrease under half the pole face.

The torque therefore increases very rapidly at light loads—proportional to the square of the current. With light overload current the torque is at least proportional to the current and with heavy overload current the torque may not increase quite as rapidly as current.

The speed is inversely proportioned to the current at light load; it decreases only slightly with change of current above full load, and at some point of heavy overload it may remain constant for considerable change of armature current until the load reaches such a value that armature resistance becomes the ruling factor.

A series motor of one-way rotation with brushes shifted for best average operation will have its field weakened by the armature demagnetization.

The torque and speed characteristic of such a motor will be similar to, roughly, that of a reversing motor with 25 per cent higher load current.

Commutating poles have the principal function of taking care of the brush sparking. They may be conveniently likened to a mechanical device which automatically shifts the brushes for either rotation, into the best sparking position for whatever load current may be carried at that instant. Another convenient likeness is to consider that they cause the entire stationary magnetic system to be rotated for the best commutation while the brushes remain stationary.

The commutating pole introduces only slight demagnetizing action, otherwise the torque and speed consideration of a plain motor apply equally well to a commutating-pole machine except for the fact that advantage is taken of the suppression of sparking by the commutating poles to make the stationary magnetic system of less strength than in a plain machine, which results in the torque and speed characteristics of a plain motor being similar to those of a commutating-pole motor at, roughly, 75 per cent of the corresponding loads of the plain motor.

Some modern designs of commutating-pole motors are such that the exaggerated characteristics become very prominent at moderate overloads, and it has been found desirable to apply a series winding to correct that feature. Commutating poles take care of the sparking throughout the entire speed range of a field-weakening motor so that a magnetic system much lighter than a plain motor may be used, but the need for a series winding is even greater. With the series winding present, such a motor at high speeds (obtained by field weakening) has the torque and speed characteristics of a compound motor.

The characteristics of the several kinds of motor having been described it now remains to analyze some motor applications and choose the appropriate field winding.

Uniform Load (continuously).—A shunt winding will serve, for the brush position may be fixed and the simplicity of connections within the motor and simple repair parts are an advantage. In case the load is a heavy-inertia one, a light series winding in addition to the shunt winding may be needed to give the desired torque with moderate current and consequent moderate sparking. In case a heavy-inertia load requires to be started quickly a heavy series plus the shunt is desirable.

In case the load has to be started frequently and quickly, a very heavy series winding in addition to the shunt is desirable and if the service is particularly rough it may even be desirable to use a plain series winding without any shunt.

Some motor applications are such that the motor is required to perform its duties without interruption, even though it may be giving indications that it is out of adjustment. It is expected that so long as it will perform its duty at all—even to the ultimate ruin of the motor—it must continue in operation until some favorable opportunity—perhaps at the week end—to investigate its trouble.

For most satisfactory operation on frequent and quick starting duty a combined series and shunt winding will cause the least current to be drawn from the line and will consequently result in only moderate sparking.

It may easily happen, however, that the shunt circuit will become opened, either within the motor or at some point between the motor and the line. If this happens the motor will continue to operate with only the light series winding. Upon some applications the motor will continue to be operated so long as it will work.

It therefore may be advisable in some cases to use only series fields, even though combined series and shunt fields would give (if always serviceable) better operating characteristics. Particularly is this true of remote-control service.

Variable Load, fairly constant speed.—If the load variations are not too great or too sudden, the shunt winding is desirable because of its simplicity. If the load variations are great or sudden, and if the variations are within the rating of the motor, a light series winding will only moderately affect the speed.

In case the load variations are extreme and fairly constant speed is desired, a heavy series winding together with a shunt winding will provide the necessary torque without unduly great line current. The speed changes will be large but must be tolerated.

Variable loads of short duration, and speed immaterial.—The series winding here gives the best operating conditions, for if the load is light the speed will be high, thereby accomplishing the desired result in the shortest time. Should the load be heavy the speed will be low.

Inertia load with occasional work.—(For example, a fly-wheel shear).—A heavy series winding is preferabe because the inertia load can give up some of its energy to the work to be performed. The motor will decrease in speed without drawing heavy current from the line and will accelerate the inertia load between the work periods. If the work periods are at close regular intervals, or if the friction load is of such magnitude as to keep the speed below the danger limit, a series winding may be used.

Table I may more clearly indicate the most desirable winding for the duty.

TABLE I.

Blast-furnace hoist	Shunt and light series
Blast-furnace top	Shunt and heavy series
Boring mill	Shunt
Car dumper	Dependent upon dumper design
Centrifugal blower	Shunt or light series and shunt
Centrifugal pump	Shunt or light series and shunt
Conveyor table:	
Continuous, light friction	Shunt and light series
Continuous, heavy friction	Series or [2]shunt and heavy series
Reversing and intermittent	Series or [2]shunt and heavy series
Coupling tapper	Shunt
Crane hoist, trolley and bridge	Series
Draw bench, continuous chain	Shunt and light series
Draw bench, reversing	Series or shunt and heavy series
Drill press	Shunt
Hydraulic press	Shunt
Lathe	Shunt
Ore-bridge hoist, trolley and bridge	Series
Ore unloader	Series
Pipe threader	Shunt
Pipe welding	Shunt and light series
Planer, shifting belt:	
Constant speed	Shunt and light series
Adjustable speed	Shunt
Pusher	Shunt and heavy series
Reciprocating pump	Shunt or light series and shunt
Roll-mill feed tables	Series or [2]shunt and heavy series
Roll-mill screw-down	Series or [2]shunt and heavy series
Saw	Shunt and light series
Shaper	Shunt
Shear without flywheel	Shunt and heavy series
with flywheel	Shunt and heavy series
and if sufficient friction	Series
Slotter, Constant speed	Shunt and light series
Adjustable speed	Shunt
Straightener	Shunt and light series
Transfer	Series or [2]shunt and heavy series

2 The shunt and heavy series is preferable but continuity of service may demand that entire series be used.

Handy Heater for Soldering Irons.

There are rather few appliances in an electrician's shop which he finds more frequent use for than he does the soldering iron. Therefore he is likely to be interested in any scheme tending to promote convenience and speed in handling this appliance. According to a writer in *Power*, the device shown in Fig. 1 is very handy in heating a soldering iron.

The base of the heater is a block of wood about an inch and a half thick by three and a half inches wide and eight inches long. In addition to this block, a piece of sheet iron or heavy tin about five inches wide and three and three-quarter inches long is needed; also a piece of heavy sheet asbestos of the same dimensions. The piece of sheet iron is bent into the form of a half circle, the bend being made parallel with the long sides. The piece of asbestos is soaked in water to make it pliable and then pressed against the inside of the half circle of sheet iron, to form a lining to hold the heat.

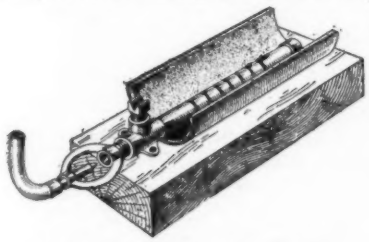


Fig. 1.—Soldering-Iron Heater.

The whole is then attached to the block of wood, with nails, as shown in the illustration. The iron hood comes almost flush on one end of the block.

The burner is made of a half-inch nipple, five and a half inches long, and 15 slots are cut halfway through it with a hacksaw, the slots being about a quarter of an inch apart. One end of the nipple is capped and the other end is screwed into a one-half-inch gas tee. It is then fastened to the block with the slots on top.

The side opening of the tee is plugged and a notch filed in the top as a rest for the handle of the soldering iron. The frame of an old sprinkler head is screwed into the other end of the tee and serves as a bracket to hold the gas jet, which is a piece of three-eighths-inch brass tube two and one-half inches long and reduced to one-sixteenth inch at the end next to the burner. The hole in the end of the bracket should be reamed so that the brass tubes will fit snugly. It can then be moved in or out, until it is in the right position relative to the air inlet. If there is no sheet asbestos at hand, asbestos cement or even fire-clay will do for the lining.

DISTRIBUTION SYSTEMS FOR MANUFACTURING PLANTS.

By John Creen.

In the case of large factories covering considerable areas, the advantages of the electrical distribution of power are easily evident. Better conditions of working are secured, valuable space is saved, and labor costs are diminished. In regard to cost of fuel, one large manufacturing firm found upon displacing 27 engines and replacing them with electric motors, that their annual saving in cost of power was about one-half.

The efficient working of a motor depends largely upon the character of the work which has to be performed, and the two factors which decide the choice of the type of motor to use are torque and speed. These vary considerably in different sorts of work. The consideration of these two controlling factors, torque and speed, gives the following conditions which have to be met: Constant torque and constant speed are the conditions met with in the case of fans and rotary pumps; constant torque and variable speed in the case of hoisting machines, elevators and rollers; variable torque and constant speed with most machine tools; variable torque and variable speed with traction, haulage, coal-cutting machinery, etc.

There are, in general, two methods of drive where electric motors are employed. These are group drive and individual drive. In the former the machines to be driven are divided into several convenient groups, each of which is driven by a motor driving a line of shafting, from which the individual machines, or tools are driven by belting. In separate driving each machine or tool is driven by its own motor, and were it not that the first cost of small motors is large when a large number of small motors are required, this would be the ideal system of power transmission. Loss is eliminated by using motors coupled directly to the machine, but the interest on the expenditure for a number of small motors, sometimes exceeds the cost of the energy lost in shafting, and therefore it is a matter of importance to determine the point at which it becomes economical to employ a single motor driving a group of tools, through a single short line of shafting. As a general rule, it is better to group machine tools into units when small, and to drive them separately when large, but this is not a perfectly rigid principle. For group working five-horsepower is often a suitable unit, but much depends upon circumstances. A five-horsepower unit is recommended because it is conducive to all-round efficiency, countershafting is not required; and during slack periods and for overtime work, whole units can be cut out to prevent their running idle. It is often possible to arrange the groups so that the load will be steady and so that the motor works efficiently.

For cranes, hoists, etc., motor driving stands without a rival. Experience proves that in electric cranes a separate motor for each motion is the best; thus, in the three-motor type crane, each motor is geared direct to its own motion without the intervention of clutches, belting, etc., so that great economy of power is secured, and all the starts are easy. During the last few years electrically driven cranes have been very largely adopted, and in general, they are much more efficient, compact, and more easily controlled than the older type.

The advantages of the three-wire system of distribution of electric power for motors and lights in a mill or factory is that it ensures economy of copper, and at the same time makes two voltages available. The lower voltage is used for incandescent lamps; and the higher, which is twice the lower pressure, is used for motors. In long feeders the copper economy is very apparent.

In a factory which has its own generating plant, care must be taken to divide the lamps about equally between the two sides of the three-wire system, in order to keep the out-of-balance current as small as possible, since the greater the out-of-balance current the larger must be the balancer required to cope with it. It should be explained in connection with this statement that the use of a direct current system with rotary compensators is assumed. If the plant is so arranged that the load can be changed over to a supply company's mains, and the out-of-balance current is large, the company will soon make a complaint. The maximum out-of-balance current permissible depends on the power required, and each company has its own rules and limits in this connection.

Factories depending entirely for their lighting on a supply company, must have the three-wires taken into the building through a triple-pole switch, with a fuse on each outer wire, the neutral having no fuse in circuit, owing to its being earthed. The three wires are split up into two separate two-wire branches, with fuses on both wires. The wires of either half must be kept entirely apart throughout the installation. The wiring of these two branches must be kept distinct throughout, and the lamps in the building so arranged as to have, as nearly as possible, the same number burning at any one time on either branch. The neutral wire is earthed at the power station, so that, between the outer wire and the earth the voltage is half that across the two outside wires. This neutral must have no fuse in circuit, but

may have a copper link which can be disconnected for testing purposes. Three-wire lighting circuits which run to the various departments in a factory, are connected to two distribution boards, one on either side of the system, the lights being so divided in each department as to bring approximately half the total number on either board. From these boards two-wire circuits for the lamps may radiate; this method enables the out-of-balance current to be kept very low, and it matters little whether the lights are all on in one room, or the whole works illuminated, there is always a fairly even number of lamps burning on either side of the system. A circuit may feed the lights in the offices; another feed the strong rooms and drawing office; two circuits may be taken from each distribution board for each floor. A two-wire circuit should be taken off one side of the system for feeding lights in the boiler house, power house and yards. This can be connected by a change-over switch to either side of the system, which is useful when the out-of-balance current is high, to switch this circuit on to the opposite side, and thus reduce it to normal. In small factories where there are a number of small rooms, two-wire circuits can be carried from the distribution boards into each room, and the lights of alternate rooms placed on either side of the system, so as to secure an approximate balance.

The system of distribution commonly adopted for the network of mains throughout the buildings is to arrange the motors and lights on separate circuits for each department or room; or, if the building be such that there are a large number of small rooms, two or three of the latter may be fed from one circuit. In any case, the motors must be on one circuit and the lights on another, so that in the event of a fault on a motor blowing a fuse or tripping a circuit-breaker, the lights are not extinguished.

In each room an incandescent lamp with a switch in circuit should be connected across the motor mains to show whether the current is on or off, so that in case of the supply failing the attendant will readily see when the current is switched on again.

A pilot lighting circuit is often run throughout a factory to enable each room to have sufficient light for the employes to find their way about the building during the non-working hours, and to supply lights for repairs to the plant when the factory is closed. The night watchman makes use of lights on this circuit when going his rounds; also the oilers who may turn in before starting time for filling the oil cups, or shaft bearings.

The main power and lighting circuits can be switched off when the factory closes down. This prevents the employes leaving lights burning unnecessarily. Lights on the pilot circuit can be in positions such as passageways and staircases which constitute a general thoroughfare through the building, care being taken that these lamps are fixed in positions where light will be required when the factory is running.

Take a piece of fixture casing about three inches long and flatten one end so that it can be soldered shut. Next solder this to the side of your torch. This makes a very convenient holder for soldering paste, and is a time saver.

Fig. 1.—Showing Service Conduit and Riser From Service Cutout.

Fig. 2.—Center of Control for Lamps in Front Rooms.

USE OF STEEL-ARMORED CABLE IN WIRING SMALL BUILDINGS.

A Note On a Recent Installation.

In our issue of September 28 there appeared a brief account of the use of steel-armored flexible cable—which wiremen generally know as *BX* cable—in providing extra ceiling outlets in the wiring of an apartment house or flat building. It will be recalled that the building in question was wired with rigid iron conduit except where outlets were to be placed on beam ceilings, at other points than in the center of the ceiling in a room. In such cases *BX* was run from the junction and outlet box in the middle of the ceiling to the other outlets.

The above construction has been criticized by certain contractors, who contend that rigid-conduit work would have been preferable here. Such objections do not seem to take into account, however, the conditions which had to be met in the installation described. Where a beam ceiling is to be installed, it is difficult, usually, for the wireman to be sure just where the beam-ceiling outlets will come and how far below the surface of the joists the under surfaces of the beams will be when these have finally been put in place. Hence he might find it very difficult to cut rigid conduit of the right length, so that the carpenter who subsequently puts the beam ceiling up and the electrician who hung the fixtures would find the rigid conduit a good fit. Similar conditions arise in wiring for porch lights, on conduit jobs. Here, too, it is not always easy to make sure, while the roughing in is being done, of the exact spot which the outlet plate must ultimately occupy. A good way out of such a difficulty is to

run steel-armored flexible cables for the porch lights, cutting the pieces long enough to leave no doubt as to each piece reaching the desired outlet when the position of this has been finally fixed upon in finishing the ceiling.

Fig. 3.—Riser Supplying Current to One Side of Building.

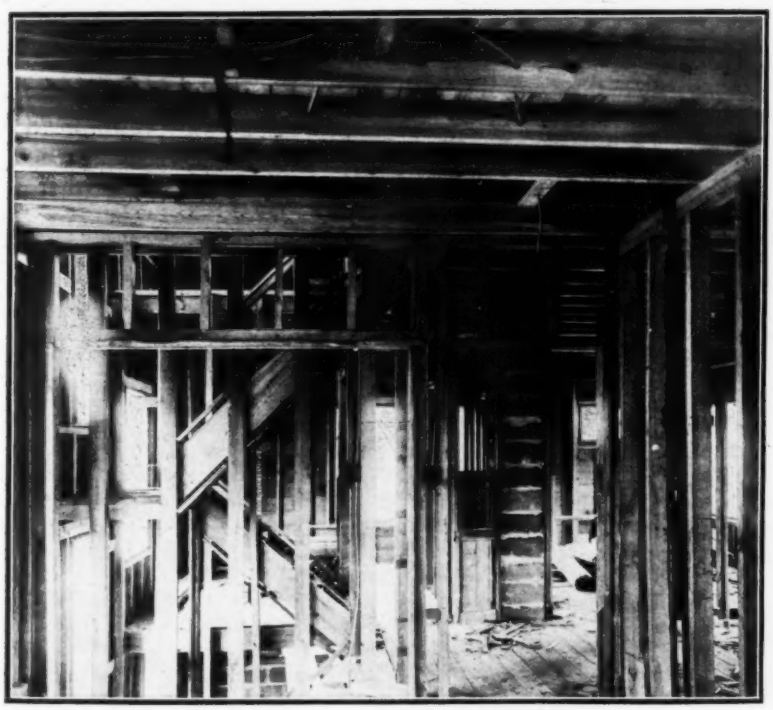


Fig. 4.—Wiring to Outlets in Large Room.

The practice outlined above, with reference to beam-ceiling lights and porch lights, is common in many places where the best of electrical-construction methods prevail. Moreover, in some localities where knob-and-tube wiring is not permitted by local inspectors, steel-armored flexible cable is used extensively in wiring certain types of new buildings. The accompanying figures are photographs of such a job, in a place of this kind. This is a small, single-story residence, in which there are seven rooms and a basement.

The construction in this installation is made quite clear by the photographs, and it is especially interesting for its simplicity and the ease with which such work may be installed. The central-station company's lines are overhead here. The service is to be run into the building under consideration through a length of rigid conduit extending from the cutout cabinet in one corner of the basement to a point well up under the roof. An interesting thing about the service pipe is that it is run in the wall—that is, between the laths and plaster on the inner side and the wall itself on the outside—instead of up the outside surface of the wall of the building as is so customary. The pipe passes to the outside by means of a bend in it near the end where the service wires will enter. Fig. 1 shows a part of the service pipe which will be concealed behind laths and plaster.

The service cutout cabinet is mounted so that gravity tends to keep the door shut, either this provision or a spring door being required by the inspection department having jurisdiction here. Two circuits run from the cabinet to supply the various outlets. One of these comes directly up from the cabinet to the ceiling of the main floor. From this point it is carried through holes in the joists to pick up the various outlets along one side of the building. The riser from the cabinet is seen in Fig. 1, beside the service conduit. The other circuit runs along the ceiling of the basement to the side of the house opposite that at which the service enters. Then it also passes upward to the ceiling of the main floor, as shown in Fig. 3. This circuit feeds the outlets on the side of the building to which it is run, and also the porch light. The *BX* is run through holes in the joists, in the way already mentioned, passing from the rear of the building to the front of it, as indicated.

Fig. 4 is a photograph of the construction in a room where there will be a lighting fixture near each of the four corners of the ceiling. There is a junction and outlet box in the center of the ceiling from which circuits radiate to these outlets. The photograph includes two outlet boxes which are installed at the top of the stairway leading from the basement to the first floor. The lights in two of the rooms and in the basement will be controlled from these two outlets.

Just inside the front door of the house, switches will be installed for controlling the lamps in the two front rooms and the one on the porch. The outlet box for these switches is shown in Fig. 2.

The fittings for the job under consideration are comparatively few and simple. Most of them were described and cuts of them shown in the article referred to at the beginning of this one. The usual type of conduit outlet boxes are employed.

Among the Contractors.

The First Implement and Automobile Company, of Vinton, Iowa, has added an electrical department to its business, and will carry a complete line of electrical supplies and do a general wiring and installation business. The company will be glad to receive catalogs from manufacturers.

Daubert & Shrecker, one of the best known firms of electrical contractors in Louisville, Ky., is installing a system of concealed knob-and-tube wiring in the residence of C. F. Nield, at 1374 South Third Avenue. The job includes outlets for about 75 lamps.

The Hatfield Electric Company, of Indianapolis, Ind., has received a contract for wiring the big new Starks Building, at Fourth Avenue and Walnut Street, in Louisville, Ky. The Starks structure is to be 15 stories in height, and will cost $600,000. It will have more floor space than any other building in Louisville.

Perhaps the largest job of electric wiring and lighting which has been done in Toledo, O., for some time is that in the Toledo Industrial Building. The entire installation was the work of the R. H. Winters Electric Company, and was done in less than a week, during which time 1,672 incandescent lamps were put in and many connections made for special lights and motors for exhibitors.

Quite an increase has occurred recently in residence wiring business in the Tonawandas, N. Y. The Hewitt Electrical Company, of North Tonawanda, reports that it is unusually busy on this class of work. The wiring seems to be equally divided between work on old residences and new.

F. A. Clegg & Company, of Louisville, Ky., has secured contracts for the electrical wiring of two of the handsomest residences that have been erected in that city. The Clegg force is to install a complete system of iron conduits in the new $50,000 residence of Louis Seelbach, the millionaire hotel-keeper. This contract amounts to $2,000. The new home of Lafon Allen, a well known attorney, at Glenview, Ky., is also being wired by the Clegg electrical department, the job costing about $1,000.

H. G. Burdorf & Company, of Louisville, Ky., a well known Kentucky electrical fixture concern, is completing work upon two important fixture jobs. The physical equipment for the electric lights in the Lincoln Institute at Lincoln Station, Ky., a colored industrial school including fifteen buildings of the most approved type, was furnished by the Burdorf company at a cost of approximately $1,000. The fixtures in the new home of the Railroad branch of the Young Men's Christian Association in Louisville also came from the Burdorf store.

J. R. Mitchell.

Among the men who have achieved a pleasing measure of success in the electrical business in the West, J. R. Mitchell, about whom the following notes are written, may well be mentioned.

Mr. Mitchell was born in Galesburg, Ill., in 1863. He has been engaged in electrical work nearly ever since he began to earn a livelihood for himself. His first work at the trade was in Minneapolis, where he served, in turn, as apprentice, journeyman electrician

J. R. Mitchell,
of the Doerr-Mitchell Electric Company.

and foreman for various firms of electrical contractors. In 1889 he moved to Spokane, Wash. Here he entered the employ of the Edison Illuminating Company as one of its foremen. After six years with this company he decided to establish an electrical contracting business for himself. With R. Doerr, the Doerr-Mitchell Electric Company was established. This concern started in business on a small scale as the pioneer electrical construction and supply house of Spokane. The company's growth has been steady from year to year. Through Mr. Mitchell's practical knowledge of electrical construction, and by employing fair business methods always, its prosperity has been uninterrupted. The company has done a large share of the electrical work in and around Spokane, both in large jobs and small ones as well. Besides its contracting business, it manufactures an attractive line of electric fixtures and does an electrical jobbing business throughout the eastern part of the state of Washington. The entire building at 118 to 120 Lincoln Street, Spokane, is used for its offices, shops and store.

Mr. Mitchell believes heartily in the "square deal" in all business transactions. He insists upon the best of material and workmanship always, and is not afraid to ask a fair price for these. To such principles he attributes his success. He is of an inventive turn of mind and has found opportunity to give occasional attention to his inclinations in this direction. Among other things, he has perfected a system of electrically operated deep mining signals, which are in present use in the Coeur D'Alene mining region.

The Doerr-Mitchell Company is a member of the National Electrical Contractors' Association. Mr. Mitchell himself belongs to the Sons of Jove, and also to the Inland Club of Spokane. He enjoys a large acquaintance in his city and in electrical circles elsewhere. He is a man whom it is a pleasure to know and do business with. He lives at South 1323 Brown Street, Spokane.

Electricity at the Ball Game.

The new baseball park of the Boston Americans is equipped with the very latest electrical apparatus for scoring the game and for distributing the story of the contest to the city and to all parts of the country. Behind the left fielder's territory and opposite the grandstand and pavilion a large scoreboard is operated electrically from a signaling desk in the press box, located in the center of the main stand and at the highest point in the structure. Every ball, strike-out and batter number are registered on the score board by the simple act of pressing a push button in the desk set, which contains 23 keys, 23 signaling buttons, an operator's telephone set and a generator circuit. The indicators in the field score board are actuated by electromagnets, 14 dry cells normally being used in the transmitting circuits. A telephone is also provided at the score board itself for use in setting up the score of innings.

The press box also contains a plug switchboard and circuits for 16 telegraph instruments, including wires for the Associated Press, local press and foreign service. The features of the game are recounted by telegraph even for downtown papers, the contention being that greater speed and accuracy are obtained than with telephone. Direct wires are in service between Boston and the home city of the visiting team at all games. Rubber-covered wires run in twisted pairs are used in all of the circuits of the press-box service.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

Attaching Outlet Boxes in Wiring Old Houses.

In wiring old houses with BX flexible conduit, I have found difficulty in attaching outlet boxes for brackets, when it is necessary to fish the conduit. I find the method illustrated in Fig. 1 very good in such cases.

Cut a hole in the lath and plaster large enough to admit the outlet box, then take a crowfoot and screw it to the lath on the opposite side of the partition; into

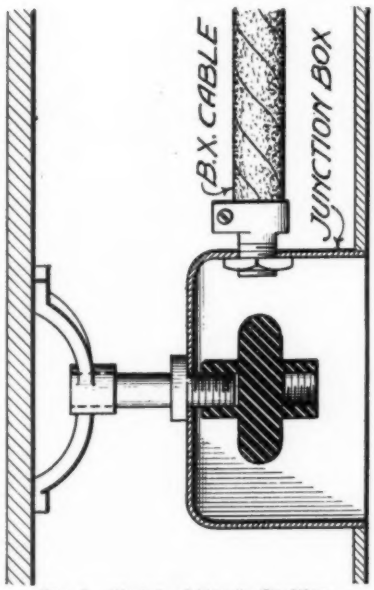


Fig. 1.—Sketch of Box in Position.

the crowfoot screw a nipple long enough to extend about one-quarter inch through the centre knockout of the outlet box when in position. Put a locknut on the nipple. Then attach the conduit to the box by its connector, after which place the box in position and fasten by means of a locknut and insulating joint. By being careful to not cut the hole too large in the wall, the fixture will be held rigidly. C. R. Robbins.

A Unique Test Set.

A handy little test set for use where there is no current can be made from the little vest-pocket flashlight batteries now so common and a little watch-case buzzer. By connecting one pole of the battery to the insulated post of the buzzer you get the test instrument complete. But it is better practice to inclose the outfit in a neat case with two binding-posts on the end for quick and varied attachments to circuits. I use a small two-point bell switch, so that I can test with the battery or with battery and buzzer.

A wireman will never bother with the cumbersome dry cells and bell again, with its wires always coming undone at the important points of the test, if he provides himself with one of these cheaply made instruments.

I also have a little receptacle from a flashlight set in the case, so that I can use it too as an emergency light in dark corners. I made my little case from an old camera. It is much admired by practical wiremen.

Ben R. Browne.

A Device Useful in Fixture Work.

Electricians assembling fixtures at the bench will often find the device made as follows quite convenient.

Take a three-eighths-inch and a three-quarter-inch crowfoot and fasten these to the bench with screws. Then screw a six-inch nipple into each one of these. In this way two stands are secured which are exceedingly handy as supports for fixture bodies while these are being wired. The body of the fixture is screwed on the upper end of the nipple used as the temporary support. E. N. Henshaw.

Removing Floor Boards.

I have noticed that in several articles published in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, the writers describe various ways of cutting the tongue on a piece of flooring when a board must be taken up in wiring an old house. The use of chisels, compass saws, etc., is recommended.

I find that by using an ordinary carpenter's scraper and a hammer the tongue can be cut the entire length of the board without leaving any marks. These scrapers are strong enough even to cut nails if necessary, and can be beveled on the cutting edge with a file. To do a good job, both tongues should be cut. If it is unnecessary to remove the entire board the tongues should be cut for about one foot further than required. The board can then be raised and cut off over a beam. This will leave the flooring in as good condition as before.

Joseph B. Josephson.

A Live "Mouse."

In wiring old buildings difficulties sometimes arise when one is fishing wires between outlets. An ordinary steel measuring tape about 15 feet long and five-sixteenths inches wide makes a very good "mouse" if wound up tight in the manner of a clock spring and placed on edge in between the floor and ceiling and released. It will be found that the tape will uncoil very readily in the direction of the outlet if it is started right. In this manner one can easily send the tape over open partitions where otherwise the tape would have a tendency to drop in between the partition walls.

Charles L. Kehl.

Contacts for Relays.

The sheet mills at the steel plant in my town are all equipped with electric drive. As the load on a motor fluctuates, the switches of the automatic-control apparatus are continually opened and closed, throwing resistance into the secondary and then out of it, and causing the flywheel to take the load peaks. This action is effected through relays in the primary circuit of the motor.

The relays were furnished us originally with carbon contacts. These, we found, wore down rapidly under the constant arcing. After a little experimenting it was found that by substituting copper for the positive contact the life of both contacts was prolonged indefinitely.

Frank M. J. Murphy.

Tool for Stretching Heavy Wires.

The following note describes a handy tool for stretching the larger sizes of wires when these are run on cleats or on knobs. The tool is made without difficulty.

Take a piece of two-by-four-inch timber about four feet long and in one end cut a slot some four or five inches deep. Then on one side of the slot screw a piece of wood—along the slot—about four inches long and two by one and a half inches in cross-section, with the narrower surface of this block next to the surface of the two-by-four timber. Next screw a single-wire cleat to the short block, and make the groove of the cleat come at the bottom of the slot, putting one side of the cleat against the timber in which the slot has been cut.

The wire to be stretched can be clamped tightly in this cleat, and, by using the two-by-four timber as a lever against a joist or other piece of wood, the wire can be stretched tightly without injuring its insulation, as is often done when pliers or other tools are used for the purpose.

On long runs, I find this tool very useful.

C. C. Sisson.

Legal Notes

LIABILITY OF ELECTRIC COMPANY FOR DAMAGES FOR INJURY DUE TO DEFECTIVE WIRING INSTALLED BY ANOTHER.

By Maguire and Mooney.

The company suppyling electric current to any premises is liable for any damages resulting from excess voltage or other abnormal condition existing on such line and it is required to exercise a high degree of care to prevent injury. It has a duty to inspect an installation before making connection to it, even in those states where the law absolves it from liability for injuries caused by defects in interior wiring done by another. While a contract absolving a company from damages due to its own negligence cannot be enforced, a contract absolving it from responsibility for faulty wiring is proper.

While it is a general rule that an electric company is responsible for damages for injury due to defective wiring when installed by itself, yet this rule was not based on the idea that the company should put in good material and workmanship alone; but it is based upon the theory of maintenance. Thus, a company putting in certain electrical equipment in a building must maintain that equipment while it is in use, or else if it is not in use then to remove it or see that no injury can arise from it. The rules about leaving the equipment in unsafe condition were discussed in the issue of February 24. The electric company, in using wires charged with a dangerous current, owes a legal duty, irrespective of any contractual relation, toward every person who, in the exercise of a lawful occupation in a place where he has a legal right to be, is liable to come in contact with the wires. But since this topic was referred to some months ago, so many new decisions have been handed down that it is advisable to go into the matter thoroughly and clear it up. There are two rules which seem to be so opposed to each other that a clear understanding should be had.

Some states have already held that a corporation which contracts to light a building by electricity undertakes to protect its occupants from injury by the electrical current so far as it can do so by exercising the highest degree of care, skill and diligence in the construction and maintenance of its plant, and thus is liable in damages for injuries sustained by a person while handling in the usual way an ordinary incandescent lamp, though it does not appear how the increased voltage, that caused the injury, has gotten on the wire.

In Hoboken Land and Improvement Company vs. United Electric Company, 71 N. J. L., 430, it was held that an electric company before sending its current for lighting purposes through apparatus installed in a building by other parties, is bound, on its own responsibility, to make reasonable inspection of the apparatus to see whether it is fit for use; and the company was held liable to a person who suffered damages caused by fire which was the result of the negligent installation of a meter by an independent contractor employed by the electric company, since, as the jury found, a reasonable inspection of the apparatus as it was left by the electrician, would have discovered the defect.

It is the general rule that although an electric company is not an insurer against injury to property or persons who, in the course of their duties, come near the wires, yet it must exercise a high degree of care to prevent injury; and all courts are agreed that if a transformer becomes defective, or wires carrying currents of different potential come in contact, permitting an excessive charge to enter a building, and injuring one rightfully using the fixtures, the company will be liable. This is shown in cases in Colorado and West Virginia where the rules absolve companies from liability for injuries caused by defects to interior wiring. The courts in those states hold that where the company is at fault in sending an excessive current into a house it will be liable for any damage. In the Colorado case, Denver Consolidated Electric Company vs. Lawrence, 31 Colo., 301, a person was injured in attempting to turn on the electric light. The shock was caused by a defect in the transformer, thus allowing a high voltage to enter the house. It was determined by the court that the patrons of the company have the right to presume that they will not be injured in using that which the company sells; and that the company will do all that care and caution can reasonably accomplish, consistent with the practical operation of its plant, to protect those who use the electric current.

Also the rule seems to be pretty well established that an electric company that does the wiring of a building and then furnishes the current is liable to one injured in carefully using the wires or equipment.

But when an independent contractor wires a building and the electric company thereafter renders its service, is the company liable for defects in the construction or maintenance of the wiring? As a proposition strictly electrical it may be stated that ordinarily the current that goes into the average residence is of the 110-volt variety, or less, and that without some deflection on the party of the duty of the company no serious injury can result to one, even though the wires in the building may have been uninsulated, or otherwise defective. Accordingly, if an injury results to one under such a statement of facts it would be on account of an excessive current carried into the house, or else from some other cause created without the house.

A representative case holding the electric company responsible in this class of cases is Gilbert vs. Duluth General Electric Company, 93 Minn., 99. The electric company was held liable in damages for the death of a person, where it appeared that the company permitted a wire to cross another wire, and when the deceased took hold of an electric-light fixture, the excessive charge passed through his body and killed him. The court held the company liable notwithstanding the fact that the defective socket was installed by another. The case of Lewis Admr. vs. Bowling Green Gaslight Company, 117 S. W., 278, (Kentucky) probably gives the true rule of this matter better than any other case. This was a case in which the Bowling Green

Company furnished the power for an electric line extending beyond the city limits of Bowling Green, to supply some suburban residents with lights for their dwellings. It hung so that it was sagging some six or eight feet from the ground, and the wire parted in two places. Its insulation was worn off in many places. It had not be inspected by the company since it had been put up, about two years previous. Lewis came in contact with the wire and was killed. The court held that the distributer of such a deadly agency as electricity could not escape liability for negligence in the manner of distribution by turning it into private wires, or on the wires of another concern, which are not safely arranged to receive and transmit the current.

Other states holding in effect to this first rule are Tennessee (Memphis Consolidated Gas & Electric Company vs. Letson, 135 Fed., 969); Pennsylvania (Alexander vs. Nanticoks Light Company, 67 L. R. A., 475), where it was decided that an electric company contracting to light a building must exercise the highest degree of care, skill and diligence in the construction and maintenance of its plant, and is accordingly liable in damages for injuries sustained by one handling in the usual way an ordinary incandescent lamp; New York (Witmer vs. Buffalo & Niagara Falls Electric Light & Power Company, 98 N. Y. Supp., 781); Alabama (Alabama City vs. Appleton, 154 So., 638); Washington (Abrams vs. Seattle, 111 Pac., 168); North Carolina (Turner vs. Southern Power Company, 154 N. C., 131); Rhode Island (Reynolds vs. Narragansett Electric Lighting Company, 26 R. I., 457.

The other rule favoring electric companies needs a little preliminary explanation before it is stated. Those companies that might be affected by the foregoing rule must also remember that if anyone received injury while handling or coming in contact with defective fixtures installed by himself the company would probably not be liable. It must also be considered that under the first rule the company is bound to inspect and properly maintain its system.

In National Fire Insurance Company vs. Denver Consolidated Electric Company, 63 Pac., 943, the same question arose. This suit was begun by some ten insurance companies to recover for the amount which they had paid on a loss. Fire broke out in the Union Depot, Denver, and the loss amounted to $60,000. The insurance companies contended that the careless and negligent manner of the wiring and the unsafe and dangerous character of the wire used would make the electric company responsible. When it came to the proof there was nothing tending to show that the electric company had anything to do with the wiring or with the inspection of the wires, or that it made any contract or entered into any engagement to keep the wires in good repair and in a safe and proper condition. The building was wired by certain electrical contractors under the employ of the Union Depot Company and the electric company was not a party to the agreement. The wiring was done by the Depot Company at its own expense, and on its own responsibility. The electric company, upon request, then delivered the current. The court held that whatever may have been the character of the wiring or the nature of the work, it was a matter with which the electric company was not chargeable. If it was negligently done, the negligence was that of the depot company which put it in, or of the firm which that company hired. To attempt to charge the electric company with responsibility because of casual knowledge which they might have had would not be justified. The contention of the insurance companies in this regard was that the electric company had no right to deliver the current without informing the depot company of the danger attending its use, and particularly of the danger attending its use where the wiring was defective or its construction unskilful and negligent.

The court in substance held that where parties undertake to wire their own property, and then apply to an electric light company to deliver a current to light the building they must be assumed to take all the risks resulting from the character of the wire which is put in the building and the method of construction which is adopted in putting it in. But the court held that when an electric company undertakes to supply a dangerous current to a dwelling house or to a building, it is bound to see that the wires put in and the connections that are made are properly insulated and protected, so that no harm will come to persons or property.

The fact that one is killed or injured by an electric shock received in attempting to turn on the electric light in the usual manner, in his own residence, is itself sufficient to constitute a case of negligence against the company owning and operating the electric power plant; and under these conditions it is for the electric company to show that it is not guilty of negligence. Besides the states already mentioned the states adhering more or less to the second rule are Iowa, Virginia, Arizona.

A good method for electric companies to reduce the risk in furnishing electricity and incurring liability under the first rule is in the contents of the contract for furnishing the current. It has been held that the electric company can partially secure itself by its contract. Thus, if the company agreed plainly to furnish the current if the first rule was in force in that state the company would have to abide by it. But if the contract is limited then it is a different question. A company cannot contract away its negligence but it can agree with the owner as to where the responsibility will rest. It has the right by contract with the owner, to furnish the current of electricity, and to allow the owner to assume the responsibility for the condition of the appliances in the building. But in any event the company could not contract to escape liability for the condition of its wires and equipment outside of a building or up to the meter inside. This is fully explained in Berstein vs. Philadelphia Electric Company, 93 Atl., 612. In this case Berstein moved into a certain house in Philadelphia, but he did not desire the use of electricity, and the electric current was cut off by a disconnection of the fuse box in the side cellar wall about five feet from the floor. The wires as originally constructed passed directly to the fuse box. So long as this continued, with the wires safely insulated, no danger existed, but in some manner of which no one had any knowledge, one of the wires had been broken and hung down and was embedded in a pile of coal. One night Berstein in shoveling the coal received a shock from this wire and was injured. The court, upon the hearing, held that, the company having elected to maintain live wires within the cellar, it was its duty to properly guard and maintain them.

These rules may seem to be so far apart that they can not be reconciled. But when they are analyzed they are not so far apart. All of them admit that the electric company in dealing with the current is producing a very subtle agency and with such a deadly element the company should not for a moment fail to exercise a high degree of care. The two rules are merely the outgrowth of a conflict of authority in determining where the responsibility rests. One practically says that it rests upon the company until the company shows otherwise; the other that it does not rest upon the company until the injured one shows that the company is responsible.

RETURN EXCESSIVE SALARY.—A local court at Chillicothe, O., decided that G. A. Vaughters, president, and other stockholders of the Chillicothe Electric Railway & Light Company, must pay back $13,000 excessive salaries drawn in the past six years.

Public Service Commissions

NEW YORK.

The Public Service Commission for the First District has approved the certificate of incorporation of the New York Municipal Railway Corporation, organized in the interest of the Brooklyn Rapid Transit Company to carry out that company's agreement with the City for the joint construction of certain new rapid-transit lines embraced in the "Dual System," and for the operation thereof by the company. The company is capitalized at $2,000,000.

The Public Service Commission, Second District, has given its approval and permission to the transfer of the control of the Salmon River water-power development to the Niagara, Lockport & Ontario Power Company. The authorization of the commission allows the Niagara, Lockport & Ontario Power Company to hold all the capital stock of the Salmon River Power Company, formerly the Oswego County Light & PowerCompany, the total outstanding amount of stock being 7,500 shares of the par value of $100 per share, and to issue its first preferred stock to the amount of $750,000, for that purpose, The Salmon River Power Company is authorized to issue $2,353,000 of bonds. The proceeds are to be used for the construction of a dam, transmission line and the necessary apparatus and appliances for transmitting electricity. The Salmon River Power Company is also authorized to lease all its franchises, works, system and property to the Niagara, Lockport & Ontario Power Company at a rental equal to 1.75 times the interest on bonds. The bonds are also guaranteed by the Niagara Company.

The Commission has authorized the Fulton County Gas & Electric Company to purchase the entire capital stock of the Cayadutta Generating Company. The Fulton Company is to pay $40,000 in cash for the stock, which has a par value of $30,000. The Fulton Company now is serving Gloversville, Johnstown, Broadalbin, Ephratah, Mohawk and Fonda. The Cayadutta Company is engaged in generating and selling electric current in the village of Fonda.

The Commission has authorized Hugh Raymond to construct a plant and exercise a franchise for the furnishing of electricity to the village of Helena, St. Lawrence County.

The Commission has granted its consent to the Frewsburg Light Company to sell to William N. Rohn all its interest in a franchise granted by the Highway Commissioner of the town of Carroll for furnishing electricity in that town. Further consent is given to Mr. Rohn to sell to the Carroll Electric Light & Power Company franchises taken over from the Frewsburg Electric Light & Power Company. The Carroll Electric Light & Power Company is authorized to exercise a franchise to construct and operate an electric light plant in that township.

KENTUCKY.

If certain conditions, set forth in a resolution adopted by the Kentucky State Railroad Commission, are complied with, an order will be entered permitting the Old Kentucky Telephone & Telegraph Company to be merged with the Southern Bell Telephone Company. The latter company has an exchange in Winchester, Ky., while the Old Kentucky lines are in Clark and Montgomery Counties. The condition upon which the sanction of the merger depends is that one set of poles and only one is to be used by the consolidated lines, removing all unnecessary equipment from the streets and highways, and that an agreement be entered into forbidding an increase in telephone rates by the Southern Bell except upon application to the Commission and after advertising the proposed changes in the daily papers for a stipulated length of time.

OKLAHOMA.

In an opinion by Chief Justice Turner, handed down in the supreme court at Oklahoma City, September 11, a city ordinance authorizing the Pioneer Telephone & Telegraph Company to raise its rates on the basis of additional subscribers, the maximum rate to be charged to be dependent upon the total number of telephones within the city limits, is declared void, while the right of the Corporation Commission to establish rates for telephone companies is upheld.

Under an order of the Corporation Commission which provides that no telephone or transmission company shall make a change in rates without first submitting the proposed new schedule to the Commission for approval, the Pioneer Company was fined $100 for violation of the order. The judgment of the Commission is affirmed.

In an opinion, dealing with the ordinance granted by the city, the court holds that power on the part of an incorporated city or town to fix municipal telephone rates can only be derived from the Legislature by express grant or by necessary implication from powers expressly granted.

As a result of this decision, the telephone company will be obliged to pay back to subscribers, the rebate due them under the provisions of a contract by which the company put up bond to cover the additional charges since the raise went into effect in 1909. It is said that about $64,000 is due subscribers in refunds.

CALIFORNIA.

The King City Water, Light & Power Company has applied to the Railroad Commission for authority to transfer all its properties to the Coast Valleys Gas & Electric Company. The King City Company is now practically owned by the Coast Valleys, and the sale merely places all the holdings in the name of the latter.

The Commission rendered a decision granting the Pacific Gas & Electric Company authority to issue $5,000,000 of bonds, to be used for construction purposes.

The Commission rendered a decision granting permission to the Home Telephone Company, of Covina, to issue 369 shares of stock.

The Commission rendered a decision granting the Western States Gas & Electric Company permission to issue $600,000 of bonds.

The Commission rendered a decision granting authority to the Tulare County Power Company to mortgage all its property to Thomas C. Job to secure an indebtedness in the amount of $175,000.

The Commission granted the application of the Mt. Whitney Power & Electric Company to put into effect a new form of meter contract for power, providing for a minimum of $24 per year.

Association of Iron and Steel Electrical Engineers.

Annual Convention, Milwaukee, Wis., September 30 to October 4.

The annual convention of the Association of Iron and Steel Electrical Engineers was held at the Hotel Pfister, Milwaukee, Wis., September 30 to October 4, and was well attended.

On Monday evening a banquet was held in conjunction with the Co-operative Safety Congress, which was holding a convention at the Hotel Pfister during the same week. On Wednesday the members attended the automobile races, and on other days visits were paid to some of the interesting local plants. There were also a number of entertainment features for the visiting ladies.

The business session was held Monday morning, at which the following officers were elected:

President: C. W. Parkhurst, Johnstown, Pa.

First vice-president: E. Friedlander, Braddock, Pa.

Second vice-president: O. R. Jones, Youngstown, O.

Secretary and treasurer: James Farrington, Steubenville, O.

The reports of the different committees of the Association were read and adopted.

The treasurer's report showed the Association to be in good financial standing and showed that the organization was incorporated on June 19 under the laws of Pennsylvania, the reason for incorporation being to give committees the necessary standing and to relieve officials of personal liability, which the laws of Pennsylvania and Ohio demand.

The Chambers of Commerce of the following cities invited the organization to hold its next annual convention at the places named: Washington, D. C., Cincinnati, O., Norfolk, Va., and Atlanta, Ga.

At the afternoon session E. C. Smith read a paper entitled "Blast-Furnace Skips and Bell Hoists." This dealt with modern developments in the apparatus for filling blast furnaces, the most modern types of construction, electrically operated, being described. The paper was written by A. E. Handy, who was not present.

T. E. Tynes, B. W. Gilson and C. Pirtle participated in the discussion.

A paper by E. D. Dickinson entitled "The Mixed-Pressure Steam Turbine with Special Reference to the Use of the Steam Regenerator" was then read. This consisted of a description of the mixed-pressure turbine and of the steam regenerator and of a typical installation.

This paper was discussed by A. B. Bartholomew, E. J. Cheney, E. L. Farrar, H. M. Gassman, J. C. Reed, W. T. Snyder, B. Stevenson, O. R. Jones, B. R. Shover, T. E. Tynes and J. H. Wilson.

The final paper at this session was one entitled "Power Problems in Steel Mills" by Wilfred Sykes.

Power Problems in Steel Mills.

The author discussed the different sources of power for rolling-mill operation and discussed the problems to be solved in choosing the best type of plant for the purpose. Where the rolls are steam-driven there is still a necessity for electric current in driving accessories. The present tendency in steel works is toward the universal application of alternating-current motors in place of direct-current. The principal drawback to the complete electrification of steel mills has been the lack of confidence in the reliability of electric drive. This has now been overcome. Advantages and disadvantages of steam drive and gas-engine drive were considered. While gas engines show greater fuel economy, the investment is much larger, and since gas engines do not permit of overloading larger capacity must be provided than normally used. Except where the load is steady and the plant worked at a high load-factor, the saving in fuel is overbalanced by the fixed charges, and a steam plant will be more economical. The combination of steam turbines and gas engines often presents the best solution. The use of exhaust-steam turbines is also considered, as well as the use of regenerators, and the effect of vacuum and of superheating. The use of electric drive on the rolls is not considered in detail, as it was discussed by the author in a previous paper.[1] Reversing mills are now electrically driven with entire satisfaction and present no greater difficulties than three-high mills. They are largely used in Europe. The equalization of the input has been so far perfected that the electrically driven reversing mill may be looked upon as a desirable load for even small generating stations. Under normal conditions there should be no question as to its economy, as it has been conclusively demonstrated that it can successfully compete with steam-driven mills, even under most severe conditions. However, the success of electric drive depends upon the careful investigation of conditions and sound engineering judgment.

This paper was discussed by B. G. Beck, James Farrington, Barton Stevenson, R. Tscheutscher, T. E. Tynes and J. H. Wilson.

The session on Tuesday morning was opened with a paper by E. J. Cheney. This paper described a newly devised equipment which varies the resistance in the rotor circuit of an induction motor with changes in power demand, so as to make the best use of the inertia of the flywheel and equalize as far as possible the load on the motor. The simplest method of doing this, which has generally been used in the past, is to leave a permanent resistance in the rotor circuit. In order to vary this resistance properly, the regulating device must operate very rapidly. Success in doing this has been due to a combination of (1) alternating-current-actuated contactors, (2) high-speed relays, (3) direct control of contactors by relays, (4) small number of notching points. Curves were given demonstrating the successful operation of this equipment and a wiring diagram shown for a control equipment with two notching points.

This paper was discussed by B. G. Beck, F. P. Townsend, Wilfred Sykes, E. Friedlander, James Farrington, J. H. Wilson, T. E. Tynes, L. R. Rankin, C. E. Bedell, C. W. Parkhurst, F. D. Egan, and B. R. Shover. Mr. Friedlander emphasized the loss of energy in driving a flywheel and questioned whether the proposed solution for regulation was the cheapest for a small plant. Above 5,000 kilowatts there was no doubt as to its advantages. Mr. Sykes pointed out that the lack of a flywheel not only entails a larger motor, but also a larger equipment throughout, even in the power house. In cases where the load is fairly constant it might be dispensed with. Mr. Farrington told of a case where, without a flywheel, the no-load current varied from 200 to 240 amperes, and during a pass the current jumped to from 1,400 to 2,000 amperes. After the installation of the flywheel the no-load current was 250 to 260 amperes, and during a pass the current reached 1,200 to 1,400 amperes. Without increasing the power-house capacity it was then possible to put in a duplicate set of rolls. Mr. Rankin told of an installation where there were 6 or 8 mills operating from one motor, each carrying load about one-ninth of the time. If the passes were properly timed the power requirement was fairly steady, but otherwise a heavy peak occurred and a flywheel was found necessary. A slip regulator was found to operate not quickly enough, and it was consequently set high rather than close to the normal load. Mr. Wilson had experi-

1. See ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, May 4, 1912, page 858.

enced trouble from limiting the control to too few steps. Mr. Bedell told of two installations, one of which had a flywheel and one had not. The induction motor on the latter is sometimes stalled, whereas the former is never loaded beyond its capacity. The friction load with a flywheel was found to be increased about 50 per cent. Several members spoke on the power requirements for rolling. This has been found to depend chiefly upon the temperature of the material and is independent of the carbon content of the steel. If the temperature is known the energy necessary for a given reduction can be computed from known data.

In closing the discussion Mr. Cheney pointed out the objection to a liquid regulator.

R. B. Treat then read a paper entitled "Direct - Current - Motor Field Coils." This will be found on other pages of this issue. This paper was discussed by F. D. Egan, C. W. Parkhurst, Brent Wiley, C. E. Bedell, M. A. Whiting and T. E. Tynes. Objections to the use of compound windings are the unreliability of the shunt field, the fact that the copper loss in it is continuous and that the exact percentage of series and shunt ampere-turns utilized is hard to duplicate when making repairs. Mr. Tynes referred to the practice of rating a motor higher when it has commutating poles.

In closing the discussion Mr. Treat stated that for variable-speed motors, control by lessening the air gap gave a better torque than by weakening the field, but for mechanical considerations it is preferable to control by weakening the field. He advocated a small shunt winding on the field in order to prevent excessive speed when the load is thrown off.

The next paper, by C. J. Mundo, was entitled, "Curves and Data for Illumination Calculations." This paper pointed out the information which it was necessary to have regarding any type of lamp in order to determine its suitability for mill lighting and the proper arrangement of units to give satisfactory results. Specimen curves of distribution, depreciation and horizontal illumination were given, with examples of different types of reflectors for use with incandescent lamps. Tables were given for computing horizontal illumination for different heights of mounting and different distances from the lamp.

B. W. Gilson found the necessary foot-candles on different parts of the work to vary from 0.72 to 1.25. The acquired depreciation of a lamp depends upon its location and exposure to dust, etc. He had found cleaning necessary at intervals of one-half to two weeks in different parts of the plant. He found an average inherent depreciation with tungsten drawn-wire lamps to average 5.4 per cent in 1,000 hours. The sizes of lamps used were 40, 100 and 250 watts.

Ward Harrison spoke in favor of lamp sizes not exceeding 250 watts. In giving data for arc lamps he thought the element of steadiness should be included. With the present low cost of 220-volt lamps he thought it preferable to run lamps of this rating in multiple on 220-volt circuits rather than lamps of lower rating in series. If run at the same efficiency low-voltage lamps give a slightly longer life. However, it is not economical to run lamps under mill conditions so as to get a life greater than from 1,200 to 1,800 hours, nor to run a lamp under any circumstances after it has depreciated to 75 per cent of the initial candlepower. Where current costs nine or ten cents per kilowatt-hour the most economical life is about 350 hours.

James Farrington, J. H. Wilson and H. M. Gassman also joined in the discussion. C. W. Parkhurst and B. R. Shover spoke in appreciation not only of the paper but of the general work which Mr. Mundo had done in improving mill lighting, and a rising vote of thanks to Mr. Mundo was unanimously passed.

The session on Tuesday afternoon was opened with a paper on "Arc Welding," by J. F. Lincoln. He referred to previous work in electric welding and then described the form of apparatus making use of a single machine in place of a motor-generator set. This machine has a single commutator and five brushes, and makes no use of resistance in the circuit for control. The current and voltage are varied by means of control switches, mounted upon a panel, the current variation during the process being automatic. This welder can be short-circuited without damage and without taking a harmful current from the line. It operates under all conditions without sparking or injurious heating. The efficiency is high, the necessary power being only 60 per cent of that required by other forms of machine. In welding, the object constitutes the positive electrode, the negative electrode consisting of a carbon rod. One hundred to 200 amperes are used. The strength of the welded material is ordinarily about 60,000 pounds per square inch. Several applications of the welding process were noted.

A paper by M. S. Plumley entitled, "The Accomplishments and Possibilities of the Oxy-Acetylene Process," was then read by J. M. Morehead. This paper pointed out the uses and advantages of the oxy-acetylene torch for welding and cutting purposes. Many examples of its use were given. Precautions to be observed and forms of apparatus for various purposes were described.

These two papers were discussed together. Brent Wiley stated that at the Westinghouse works the oxy-acetylene method was used for thin sheets, while for heavier work arc welding was applied and in many cases replaced riveting. The efficiency of the method is usually a secondary matter.

E. H. Martindale, in answer to a question, stated that the spindling of the carbon could be prevented by the use of a graphite electrode, which does not oxidize so rapidly or conduct heat back from the arc so much as carbon. It is also well to keep the arc out of a draft.

George Hills gave a lengthy discussion, in which he stated that automatic regulation was very desirable. The object of preheating is not to get the necessary temperature but to make allowance for contraction and expansion. If this is properly done, arc welding will do almost any kind of a job. He agreed with a previous speaker, however, that each method had its own field. The use of thermit is advisable for very large work and oxy-acetylene for small work, while arc welding is most suited to the intermediate field. For crank shafts, wobblers, etc., the arc welder is preferable and is much cheaper than the other methods. He recommended the use of ferro-silicon in welding cast iron. Injury to the eyes is entirely avoided by the use of two thicknesses of glass, colored ruby and blue. Manganese-steel can be welded, but to get good results should be hammered after it has cooled down to a very dull red heat, but not before. Where a flux is needed he recommended two parts borax, one part potassium chloride and one part charcoal, to which a sprinkle of pumice stone may be added if desired. But a flux should not be used with a carbon electrode nor in welding cast iron.

R. F. Patterson, E. Friedlander, B. W. Gilson, J. A. Seamans, James Farrington, T. E. Tynes, W. T. Snyder, C. A. Kafer, C. Pirtle, Wilfred Sykes, J. C. Reed, M. A. Whiting and F. R. Fishback also joined in the discussion, which was closed by Messrs. Lincoln and Morehead.

C. T. Henderson, chairman of the Entertainment Committee, was then presented by the other members of the committee with a clock as a token of their appreciation of the work which he had done.

The final paper of the session was one by Ward Harrison, entitled "Incandescent Lamps in the Steel Industry."

The Incandescent Lamp in the Steel Industry.

After explaining the terms used, the author considered the light flux available for a unit consisting of an incandescent lamp with reflector. A porcelain reflector absorbs about 35 per cent of the incident light. If used only in the upper hemisphere this might permit an efficiency of 82.5 per cent. With light restricted to a zone 60 degrees from the vertical the absorption will probably reach 40 per cent of the total flux. Distribution curves and photometric data are given for three typical reflectors. As reflection from a porcelain surface is usually diffuse, the distribution from the reflectors of the same diameter is little affected by the shape of the reflector. The condition of the surface is, however, important and porcelain which appears gray or bluish in tinge should be avoided. The three important factors are (1) dimensions of reflector relative to lamp bulb, which determine the shape of the distribution curve; the sharpness of shadows and the amount of glare; (2) quality of the surface, which determines its efficiency; (3) the mechanical construction, which determines its durability. Examples were then given of shops lighted by arc and incandescent lamps, the operating cost of the latter for equal illumination being much the smaller.

R. S. Iremonger suggested that manufacturers should give tables of curves of the total lumens which would fall from a given unit within specified zones in a horizontal plane at definite distances. He also referred to a compound which is now being placed in Mazda lamps which diminished the inherent depreciation, with the result that after 1,000 hours 90 per cent of the initial candlepower was retained.

C. J. Mundo stated that mill men cling to the flat type of reflector. He pointed out that approximately the same distribution curve could be obtained with a deep reflector if placed in the proper position. He referred to an installation of Mazda lamps where 11,000 watts are used to illuminate 16,000 square feet or about 0.7 watts per square foot.

The remainder of the discussion, participated in by James Farrington, T. E. Tynes and H. M. Gassman, consisted of questions which were answered by Mr. Harrison. He stated that the distribution was little altered by using a rough or wavy surface with a porcelain reflector. Aluminum paint on a reflector gives slightly less efficiency than porcelain. He opposed Mr. Iremonger's proposal on account of the work involved, as he thought that the same purpose could be accomplished more simply.

The next paper before the convention was read by its author, C. E. Clewell, whose subject and a summary of whose remarks follow:

Modern Illumination in the Iron and Steel Industry.

The importance of natural light to mill operatives should be emphasized. Windows in mill buildings should be sufficient in number to admit ample light in the daytime, and their arrangement should be such as to make it generally unnecessary to provide artificial lighting during the day. Good artificial lighting represents a cost of perhaps one or two minutes of wages per day in excess of what an inferior lighting system would cost. Where the artificial lighting is bad half an hour to an hour or even two hours, is lost per day. In iron and steel plants 220-volt direct-current energy is frequently employed for motors and lights but 25-cycle alternating current is fast becoming standard for steel mills. Carbon and tungsten lamps and several types of arc lamps operate satisfactorily on this frequency.

Iron and steel buildings generally consist of large ground areas and high roof trusses. The surroundings are usually dark. Lamps must generally either be attached to the roof, or to girder or roof trusses, or they must be suspended from stringer boards and similar devices mounted between roof trusses. The crane service limits the mounting height either to a position directly above the crane or on the sides of the buildings, between columns. High mounting is desirable, in order to avoid glare. Lighting and motor circuits should be kept entirely separate.

In many cases, good general illumination is necessary, the use of individual lamps being very undesirable. For high ceilings large lamps should be used, and these mounted high, while for low ceilings lamps of relatively small candlepower should be employed.

In large yards there should be, as a rule, a fairly uniform distribution of relatively low intensity.

Adequate illumination means sufficient illumination to enable work to be carried on in the night with the same degree of ease as in the daytime.

As a typical case the foundry is selected for detailed treatment.

The lighting problems in these locations are peculiar because, not only must adequate light be furnished for the working operations, but accidents must be prevented and the surfaces of molds which are nearly always dark must be sufficiently lighted. This result, with dark ceilings and walls, necessitates a large number of relatively high-candlepower lamps. The nature of the molds requires a small shadow effect.

The steam and dust in the air forms an obstruction through which the light must penetrate, and the deterioration of lamps with the deposits of dirt is apt to be somewhat more rapid than in other locations. It is, therefore, most important to provide for a rather high ultimate deterioration of the lamps. It is obviously important in this connection to select a type of lamp which is capable of penetrating the dust and dirt.

Intensities of two or three foot-candles have been found entirely adequate for successful foundry work.

Mr. Clewell's paper then went into a discussion of the illumination of various other departments of the steel mill. The spacing of lamps and their mounting height were gone into in detail, for various kinds of service, and proper schemes of lighting were illustrated by means of diagrams and of photographs.

In conclusion the author emphasized the necessity of systematic maintenance of lighting units. Lamps and reflectors should be kept clean, he said, and renewals made at the proper time. Maintenance had been too much neglected.

This paper was discussed by Ward Harrison, F. D. Egan, G. W. Richardson, E. Friedlander, James Farrington, E. B. Rowe, F. W. Stevens and C. J. Mundo. Mr. Harrison showed photometric curves of flaming arcs and emphasized especially the necessity of steadiness of candlepower. Mr. Egan commented upon the necessity of ample illumination in mills, and spoke of the liability of lamps being hung higher than necessary. He said, also, that when arc lamps are run on power circuits more frequent trimming is required than when they have their own special circuits. Mr. Richardson spoke of the use of tungsten lamps on cranes, and Messrs. Friedlander and Farrington added some experiences of their own with tungsten lamps in such service. They had not been troubled with breakage from jarring. Mr. Rowe urged frequent cleaning of lamps. The cost of good lighting is about one-half of one per cent of gross wages in steel mills, according to Mr. Stevens, but improved lighting sometimes improves the output of the plant as much as eight per cent. Mr. Mundo spoke at some length of the advisability of keeping lighting and power circuits separate.

Effect of Temperature on Insulation Resistance.

C. E. Skinner read a paper on this subject.

Insulating materials may be divided into two general classes. In the case of organic materials temperatures above 90 degrees centigrade cannot be exceeded without deterioration. Inorganic materials will stand higher temperatures.

It is very important that there be control of the temperature at which apparatus may operate, and to the designer it is very important that he get some idea of the heat-conducting power of insulating material, especially when used on high-voltage apparatus where considerable thickness of insulation must be massed in order to withstand the working stresses on the apparatus. Very considerable difficulties have been experienced in the determination of the heat-conducting power, or the thermal resistivity, of insulating materials, but a number of observers in different places have given this subject much attention, and figures for many materials are now available which are probably correct within rather wide limits.

It is desirable to limit the load which any piece of dynamo-electric machinery will carry by the ultimate temperature rather than by any other criterion, and such limitation could be taken care of by a temperature measurement on any accessible part of the machine which had been found to bear a definite relation to the ultimate tem-

perature attained by any part of the machine. Such temperature might be many degrees lower than the temperature which was considered the limiting temperature for the apparatus in question.

In discussing the foregoing paper, Messrs. Friedlander and Tynes raised questions as to the effect of oil and dirt on windings, and also asked about the use of aluminum conductors for winding dynamo-electric machines. Mr. Skinner said that the effect of oil and dirt was confined largely to the surface of the winding. One of the most difficult things about aluminum windings was the difficulty in making good joints. No solder entirely satisfactory for use with aluminum had been discovered.

At the conclusion of this discussion H. L. Barnholdt read a paper prepared by H. C. Specht. "Windings of Electric Machines" was the subject of this paper.

Windings of Electric Machines.

In order to attain the best power-factor in induction motors and the best efficiency, a large number of slots with small openings is required. Iron wedges are sometimes employed to close the open slot magnetically. In direct-current machines, however, the slot opening is not so important, and these are built, as a rule, with open slots.

For rough service, mechanical ruggedness and ease of repair are more important than many of the electrical details. The question of insulation is also an important one.

Mr. Specht's paper then took up and discussed the types of windings for such service as is required in iron and steel mills.

This paper was discussed by F. E. Tynes and G. W. Richardson. Mr. Richardson said his company had more trouble from the breaking down of the insulation in the commutators of motors than from poor service on the part of armature windings. Mr. Tynes stated that troubles of this kind arose generally from the use of the wrong sort of mica in the commutator.

The afternoon session on Thursday was devoted to the transmission of power. The first paper was read by William D. Ligon. His subject and an abstract of his paper follow.

Underground System of Distribution.

Underground work, so far as relates to circuits for power or lights, is now practically limited to the use of tile and fiber conduits for inclosing the conducting cables and wires of the system. Multiple and single-duct tile has been in use for about 25 years, and is manufactured from vitrified clay, in single duct, and multiples of two, three, four and six ducts in either round or square bore. The ducts are laid end to end, with dowel pins to hold in alignment, and usually surrounded with an envelope of concrete about three inches in thickness, as a protection and reinforcement to the entire structure. Joints are staggered and wrapped with either burlap or iron and cemented with mortar.

This material, if properly vitrified and glazed, will last indefinitely; when free from iron it possesses high insulating properties, and costs less per duct foot than any other conduit on the market to-day. It also possesses great mechanical strength, and shows an average puncture test of 25,000 volts dry and 21,000 volts after immersion in water for 150 hours.

While the dielectric strength of tile is very high, the insulation of a system is greatly lowered, in consequence of the large number of joints to be closed with cement or other moisture absorbing material, and instead of the entire system testing out at 21,000 volts it will be found, when taking the joints into consideration, an installation will rarely show a dielectric strength greater than 5,000 volts, depending, however, on the general characteristics of the earth surrounding the ducts.

In making the joints in multiple duct tile, it is impossible to prevent communication between the ducts, and due to this condition multiple duct affords the lowest protection to the cables, as the action of electrolysis is more liable to occur than in single duct installations.

The weight increases the cost of freight, handling, carrying and laying, and in propositions involving the use of tile the question of breakage is also an important item of consideration and may often amount to as much as one-tenth of the total shipment.

Due to off-sets, seams and roughness at the joints, extreme care must be exercised in pulling through the cables to prevent abrasion to the sheath, and if cables are not installed properly, short circuits and cable troubles will be encountered, resulting in shutdowns and expensive repairs, which increase the operating expense to an excessive degree in the course of a year. Few manufacturers of vitrified clay recommend the use of tile bends in subway distribution, due to the roughness of the interior, and it therefore becomes necessary to replace with manholes or handholes, which increases the cost of the entire system. It has been demonstrated by experience that the cost of subway installation where tile is used for conveying the cables is somewhat higher than the same installation with the newer type of material.

Fiber conduit is the most recent addition in materials for subway distribution systems that has been developed to meet the new conditions of service. It has been in use about eight years and is formed in cylindrical shape from fiber or wood pulp under pressure. The wood pulp is thoroughly saturated with a bituminous compound and any vegetable matter or bacteria which would tend to promote decay is killed by the pressure of about 6 per cent of creosote salts in solution. It has been shown that fiber conduit will stand an average puncture test of 32,000 volts dry and 24,000 volts after immersion in water for 200 hours.

Results obtained during the eight years fiber conduit has been used commercially indicate that the life of this material is indefinitely long.

Injury to the lead coverings of cables during the pulling-in process is avoided entirely when fiber conduit is used, and current leakage at joints is also prevented. This material is not affected by stray currents. It is free from the effects of water and gas, too; that is, it is impervious to these.

Mr. Ligon's paper was followed by one on "Underground Cables," by Charles R. Sturdevant, which will be published, in part, in another issue.

The third paper of the session was on "Tubular Poles for Line Construction," and W. T. Snyder was its author.

Tubular Poles for Line Construction.

The 30-foot cedar pole is about 140 years old when cut, and the chestnut pole about 50 years. The average life of the wooden pole being only about 15 years, it would be necessary to keep about 10 poles growing for each pole in use, in order to keep up the demand. The present demand on our forests is over 4,000,000 poles a year. It appears, then, that the supply is not going to be kept up.

The tubular pole can be transported easily, compared with the steel tower and the concrete pole. Also, its length can be changed without difficulty. Guards are sometimes used to prevent the corrosion of the pole at the ground. Another way is to incase the butt in concrete.

Tables taken from the National Tube Company's Book of Standards give valuable data concerning the tubular steel pole.

Reinforced Concrete Poles.

The next paper scheduled was by R. A. Cummings, and the title was as stated above. In the discussion of this subject, to which Lewis R. Rankin and H. M. Gassman contributed, methods of casting these poles, fastening cross-arms to them and stepping them were given considerable attention.

Mr. Rankin said concrete poles were about four times as heavy as cedar poles of the same dimensions. Wooden poles cost from one-half to one-third as much as concrete poles; the life of the former is 15 years or so, while that of concrete poles is unlimited.

Structural-Steel Poles and Towers.

The paper on this subject was presented by R. Fleming.

The loads on poles or towers are of three kinds: (1) vertical or dead loads; (2) loads due to lateral wind pressure; and (3) unbalanced loading in the direction of the line due to breaking of the wires. In designing towers, the material must be proportioned for maximum stresses due to any combination of these three loads.

Specifications often require that towers withstand certain artificial tests. The conclusions from these are frequently very misleading, since the conditions are liable to be quite different from those met with in practice. When towers fail, it is generally under service or loads for which they were not designed.

In what are known as flexible towers, about one tower in every ten is deadended, or made perfectly rigid, to take longitudinal stresses, the intervening towers being made to withstand only the dead weight and transverse wind loads.

Mr. Fleming's paper included a discussion of foundations for towers, and also descriptions of the towers and poles of various transmission lines.

Underground Electrical Conduit Construction.

W. W. Grant followed Mr. Fleming with a rather informal but very interesting paper on underground construction. The talk was illustrated with a large number of lantern slides, which, the speaker explained, were made from photographs of work installed by G. M. Gest.

In the discussion of the papers on transmission T. E. Tynes, James Farrington, J. C. Reed, C. W. Parkhurst, T. A. Worcester, R. F. Freeman and B. W. Gilson took part.

Mr Gilson said fibre duct did not abraid lead covering of cables during their pulling in, and Mr Tynes spoke of the necessity of placing concrete under a run of tile duct to prevent its settling. Mr. Reed said that he would soon have to replace the wooden poles now used on an 11,000-volt line, and that this must be done without interrupting the service. He proposed to use concrete bases, and fasten wooden tops to these with suitable clamps. Mr. Parkhurst spoke of the exactions of railway companies when high-tension circuits have to be carried across their rights-of-way.

Mr. Freeman told of the difficulty in figuring the cost of underground conduit work, because of changing local conditions. He said further that for low-voltage work there was no need of supplying special support under conduit lines.

The sessions of the fourth day of the convention were joint sessions with the Co-operative Safety Congress, which had been in session in Milwaukee throughout the week.

Two papers of an electrical nature were scheduled for these sessions. E. H. Wentz, who was to have read a paper on "Hoist Limits" being absent, informal talks on the subject were made by C. S. Rowe, T. W. Richardson, and James Farrington. These talks all emphasized the importance of limit switches of the proper design.

The other paper was by R. B. Davenport, whose subject was "Dynamic Braking." This paper dealt at length with the braking effect of the hoisting motor when made to deliver power to the line in lowering heavy loads.

Exhibits.

A number of manufacturing companies had attractive displays of apparatus at the convention headquarters. Companies exhibiting electrical apparatus were: The Doubleday-Hill Company (exhibiting Adams-Bagnall products); Detroit Fuse Manufacturing Company; Economy Fuse Company; Standard Underground Cable Company; Electrical Engineers Equipment Company; General Electric Company; Benjamin Electric Manufacturing Company; Thompson Electric Company; Dyer Flaming Arc Lamp Company; Electric Controller & Manufacturing Company.

Lighting of Capitol at Madison.

A unique lighting system has been evolved for the interior of the big dome of Wisconsin's new capitol at Madison. Not a single light will be visible from below. Reflectors will throw the light upwards into the dome.

Fifteen hundred 40-watt lamps will be used in lighting the interior of the dome. The lamps will be arranged in four tiers from the attic level to within ten feet of the pinnacle of the dome. The total candlepower of the lamps used will be over 40,000. The reflectors, which will throw the rays from the incandescent lamps upwards, will enable a person standing below to have an unobstructed view of the arch of what is said to be the largest dome in the country. The first of the four tiers will be placed at a level of 50 feet above the ground floor, the second at a height of 82 feet, the third 136 feet above the rotunda base, and the fourth 185 feet. There will be approximately 350 lamps for each tier.

The usual cluster and electrolier system will be employed for the first three floors of the rotunda and lamps of the same voltage will be used here as higher up. A feature of the balcony lighting will be the large clusters and electroliers which will face the four great stairways leading into the rotunda.

It is stated that it will be more than a year before work can be started on the dome lighting system. The placing of the exterior stone has just been well begun and the interior finishing will not be started for another year.

Electrical Market in Spain.

According to the German consul at Barcelona, there is a large demand in Spain for electrical apparatus, such as dynamos, motors, incandescent lamps, transformers, etc. There are, he states, excellent opportunities for doing business, especially in the case of the lighter machines weighing up to eight hundredweight, as well as in the case of small electric fittings.

Austria-Hungary is building hydro-electric plants to cost more than $24,000,000.

ELECTRICALLY DRIVEN ICE-MAKING PLANTS.

By George S. Merry and George J. Kirchgasser.

Refrigeration is a subject of great and daily increasing interest and the field of usefulness is continually widening. Artificial ice-making, even in sections of the country where cold winters are experienced, is now common. The enormous quantities of fruit shipped out of the South and Southwest awakened the ice and cold-storage interests to the great possibilities in that direction in addition to the regular domestic and shop-keepers' trade. These ice plants are usually taxed to their limit to furnish sufficient ice for the refrigerator cars and cold storage for fruit and truck awaiting shipment. Many of these ice plants are operated in connection with electric lighting plants and many operate on central-station power.

In Northern cities the artificial-ice plant using central-station current is making its appearance. In Buffalo, Detroit, Chicago and even as far north as Seattle, artificial ice is made and central-station current found to profitably answer the power question. From the central-station standpoint the commercial artificial-ice and cold-storage plant is most desirable; the load-factor is very high, and the greatest demand is in summer when ordinarily the central-station load is lightest.

The science of refrigeration is based on the absorption of heat when a liquid is transformed into gas. Anhydrous ammonia (NH_3), which is pure ammonia gas, compressed to a liquid, is the most extensively used refrigerating agent. Gaseous ammonia can be liquefied at a pressure of 128 pounds to the square inch at a temperature of 76 degrees Fahrenheit, and the pressure required to produce liquefaction rises very rapidly with the temperature. If the temperature is low, less pressure is required. This is the reason why the average tons of ice from the same refrigerating plant varies according to seasons of the year, 50 tons of ice per 24 hours being average for a 100-ton-capacity refrigerating machine. In winter this may increase to 60 and 65 tons and in summer drop to 40 tons of ice.

The compression system, using brine as the liquid medium, is the system in greatest use. A continuous cycle is performed. Ammonia gas is sucked into the compressor cylinder, is compressed and discharged (at from 125 to 200 pounds pressure) to the condenser, where the cooler temperature and high pressure change the gas to

liquid. Passing this liquid through expansion coils allows the pressure to decrease. This causes the liquid to change to gas and in doing this heat is absorbed from the atmosphere, if the expansion pipes are in a storage room, or from the calcium-chloride or common-salt brine in case of ice-making process. A brine pump is used to circulate and agitate this cold brine through the piping in the ice tanks. Heat is absorbed from the water thus freezing it, while the warmed brine passes back to the cooling tank. After the ammonia becomes gaseous in the expansion coils it is sucked back again into the compressor and the cycle is begun over.

In the direct-expansion system the liquid ammonia passes directly to the ice-making tanks and there expands to its original gaseous form, absorbing heat from the water by so doing. This gas is drawn back to the compressor again and compressed to a liquid.

When artificial ice was first made there was not much attempt made to produce ice of quality. It was opaque, due principally to the rapidity of the freezing process and because no means were employed to allow air and impurities to escape. Now clear, transparent ice is desired. Freezing very slowly at a temperature a little under the freezing point is impracticable for commercial reasons, but agitation of the water during freezing (producing raw-water ice) or distillation of the water before freezing are satisfactory methods used today.

There are a number of systems in use in which the agitating method is employed, the most common being the plate system, in which freezing plates made of pipe coils are immersed in tanks filled with fresh filtered water. The cooling medium, ammonia or brine, is circulated through the coils, causing thin slabs of ice to form on the sides of the plates in which the coils are imbedded. In this process air is injected at the bottom of the tank of water, keeping it in constant agitation.

Agitation of the fresh water in the cans of a can system by means of a jet of air is satisfactory where the water is free from impurities. But in some localities magnesia, sulphate of soda and other impurities are found, which makes it necessary to treat the water before it is placed in the freezing cans.

The method of purification by distillation before freezing is used with the can system of ice-making to the greatest extent.

As an aid to cleanliness and purity, central-station power is important. The plants referred to below are both models for cleanliness. Motor drive eliminates all engine oils, grease, soot, ashes, etc. No coal, coal-storage yard, boiler room and space for engines are required. There are no troubles incident to the dependence upon coal supply and it is possible to choose the most advantageous location for the plant. The ice plant using central-station current requires but few men. All efforts and capital can be expended in making and distributing ice, which is the business of an ice plant—not the generation of power to run the plant. Because of the high load-factor and steady load, the central station can offer a low rate and yet gain a very desirable business, one which should increase and become more common throughout the country during the next five years.

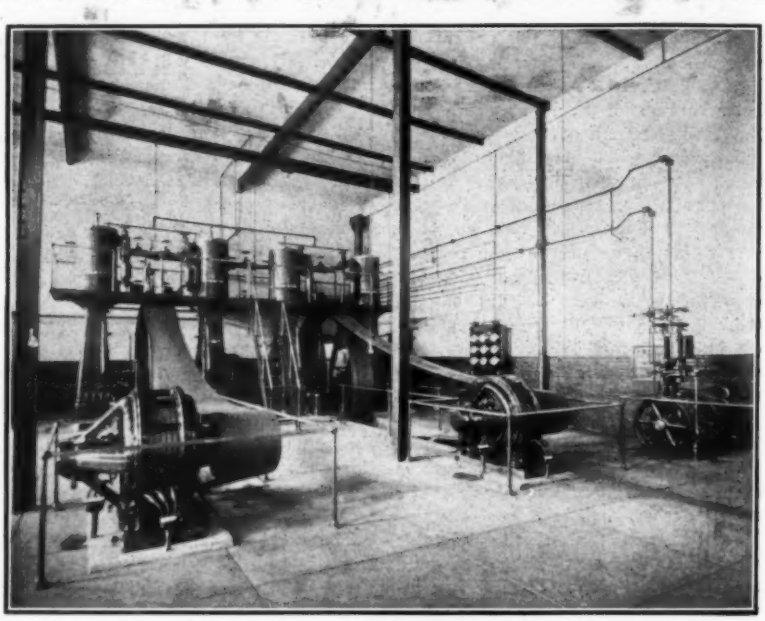


Fig. 1.—Refrigerating Machine Room, Webster-Citizens Ice Company.

Notwithstanding the fact that Lake Erie and several nearby small lakes yield large ice harvest each year, it has been found that the making of artificial ice in Buffalo, N. Y., is practicable and profitable. For about three years the Webster-Citizens Company and the Crystal Ice Company have been operating ice-making plants using central-station power, and the former company has added two new plants since the first, depending less and less upon the harvesting of natural ice.

Buffalo and vicinity has three months at least, of cold weather, and up to three or four years ago depended entirely on the supply of natural ice harvested from Lake Erie, Chautauqua Lake, Buffalo River, etc. But manufactured ice has come to stay. It is clean, uniform and the quantity is not dependent upon the kind of winter. The ice dealer has no rush periods, as during ice-cutting time, and requires no large storehouses, as the manufactured ice is turned out and delivered daily.

The fact that distilled water must be used in ice making in some localities, and was thought to be necessary in many others, has been one of the important factors against the use of central-station power for driving the ice-making machines. It is argued that where steam-driven compressors are used, the exhaust steam can be condensed and used for making the ice, after removing the oil, grease and dirt. However, the Webster-Citizens Ice Company uses central-station power and yet distils its water. But the usual boiler method used in the steam-driven plant is replaced by just two low-pressure, 90-horsepower, horizontal boilers mechanically stoked, made by the York Manufacturing Company, furnishing steam at about 90 pounds pressure from water pumped from a well. Where the can system, as used in this plant, is employed, the method of obtaining transparent ice usually demanded by the domestic trade is to distil the water. In the steam-driven plant gases exist in the exhaust steam which often requires reboiling, while as the exhaust steam is not sufficient, live steam is mixed in directly from the high-pressure boilers. The distilled water at the Webster-Citizens plant is not used for any purpose except ice-making; it need not have grease, oil, etc., removed, but can be run directly to the freezing cans. The two low-pressure boilers are used with a series of multiple stills which provide a large amount of distillate economically.

Another proposed method of producing clear ice from raw water in the can system is to agitate the water during freezing to free the ice of air bubbles. This produces good ice if the water be free from impurities. With some waters it is necessary, when the block is nearly frozen, to pump out the core (as this freezes last), which contains the impurities, and refill with fresh or distilled water, while with others it is necessary to purify the water before passing it to the cans.

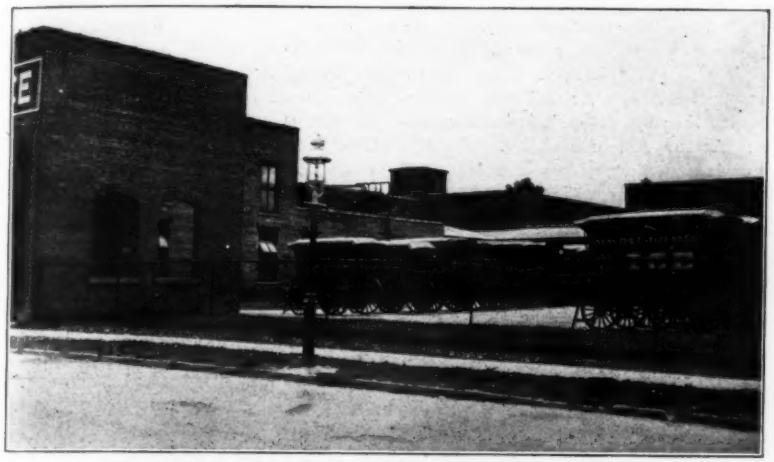


Fig. 2.—Essex Street Plant of Webster-Citizens Ice Company.

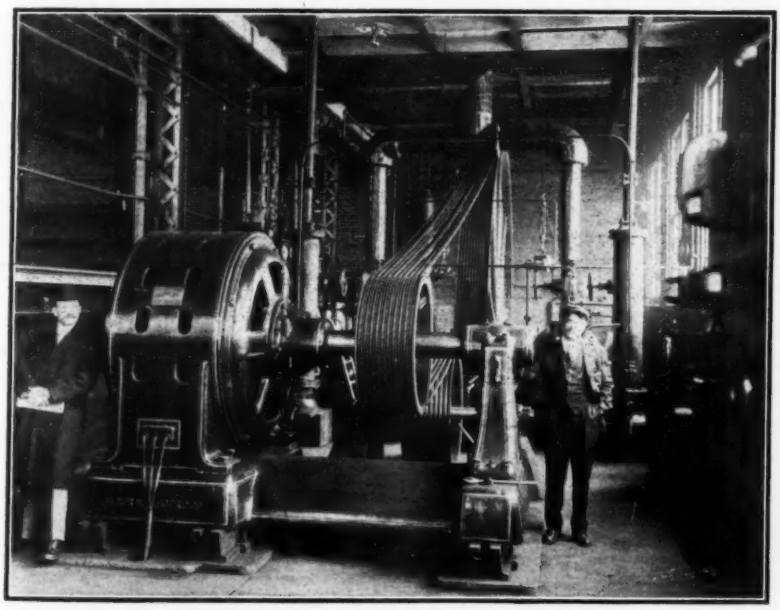


Fig. 3.—Motor-Driven Compressors, Crystal Ice Company.

In the compressor room, shown in Fig. 1, the two principal machines are the vertical single-acting, safety-head type of ammonia compressors built by the York Manufacturing Company, belt-driven by two slip-ring-type, three-phase, 25-cycle, 2,200-volt motors. Each of the two refrigerating machines averages 50 tons of ice per 24 hours.

The Mechanic Street plant of the Webster-Citizens Company is but a short distance from the overhead transmission lines of the Cataract Power & Conduit Company, running along the edge of the Erie Canal. The 2,200-volt current is, therefore, brought into the compressor room, running direct to a primary panel equipped with automatic oil switch and disconnecting switches. Each of the large motors has a switch panel and a drum-type controller for reducing the speed of the motor from normal, 500 revolutions per minute, through about a dozen speeds below this. The leads to the stator and rotor are carried in conduit under the concrete floor. Two 20-kilowatt transformers, connected in open delta, are also located in the corner where the high-voltage leads enter. These transformers step down from 2,200 to 440 volts, the latter being the pressure at which the additional motors about the plant are operated. Buying current at 2,200 volts secures a low rate, and using 2,200-volt motors eliminates the purchase of transformers, besides eliminating their losses.

There is one five-horsepower slip-ring motor driving by belt a small two-ton refrigerating machine, shown near the right wall in the illustration, Fig. 1. There is one 5-horsepower and one 10-horsepower motor driving horizontal Deane pumps for pumping well water into tanks; one 3-horsepower motor geared to a Sandusky vertical pump used on the filter and one 3-horsepower motor geared to a Deming vertical pump operating in connection with the condensing stills. Four vertical-type brine agitators are used, each driven by a direct-connected squirrel-cage type of motor of 3-horsepower capacity. There is a total of 388 horsepower of motor capacity in this plant and the total horsepower-hours for the first year of operation, 1910, was 1,772,568.

Since this first plant proved so successful the Webster-Citizens Company has added two more ice-making plants, one of which was completed about a year ago and one during the summer just passed. These plants are similar to the first except that they each contain one refrigerating unit instead of two, their capacities each ranging between 45 and 60 tons per 24 hours.

The Essex Street plant, which is shown in Fig. 2, is located in the West Side residence section of Buffalo, while the plant just completed on Gillete Street is convenient for the growing north, northeast and northwest sections of the city. The low construction of building is carried out in all. High-voltage (2,200-volt) motors, which are used to such a great extent in Buffalo and vicinity are used in both the new plants for driving the compressors,—one in each. The smaller motors, as in the first plant, are wound for 440 volts and the same general arrangements are carried out.

Particular note should be made of the fact that the Webster-Citizens Ice Company, instead of building a large-sized ice-making plant in one location, has begun the establishment of a number of comparatively small ice-making plants located each with respect to the territory to be served. No distributing or storage stations are required with this arrangement, as each plant distributes the ice as it is made and with the least amount of waste. This establishment of numerous small plants is only possible where central-station power is

used, as economy in a steam-driven plant is only gained by centralization in one large plant. This fact is a very strong one in favor of the use of central-station current.

The motor-driven compressors or refrigerating machines used in these plants have proven highly satisfactory. The speed variations provided by inserting external resistance in the rotor circuits, while not the most efficient means of electric-motor control, compares favorably, however, with steam-engine control.

The plate system of making raw-water ice is employed by the Crystal Ice Company, Buffalo. This plant is very compactly arranged and is located near the downtown district. The capacity averages 95 tons per day of 24 hours, and 2,200-volt, three-phase induction motors are used, as in the case of the Webster-Citizens plant, for driving the ice machines; while 220-volt motors are used for driving the pumps, cranes, conveyors, saws, etc. Current is supplied by the Cataract Power & Conduit Company.

As distilled water is not used, there are no boilers or other heating apparatus in the building. Filtered city water is employed, agitated during freezing by a blower driven by a 7.5-horsepower motor, which produces transparent ice free from air bubbles. The water is placed in 19 tanks, each of which has immersed in it four flat plates (containing coils) standing vertically. The direct-expansion system is used in this plant, so no brine is passed through the coils in the plates, but compressed liquid ammonia which as it changes back to vapor absorbs heat from the water. Layer after layer freezes to the plate in much the same way as ice forms naturally, growing thicker away from the source of cold and into the water. When the cakes grow to a thickness of about 11 inches the plate formed, 15 feet by 9 feet by 11 inches, weighs 3.5 tons. Ordinarily it takes about five days to freeze a tank or 28 tons of ice. There are 19 tanks so that three to four of these are completed and cut up each day.

The original installation here consisted of the one ice machine, driven by a 200-horsepower variable-speed motor, the connections from the control board to the motor being under the floor in lead sheath and conduit. This motor, shown in Fig. 3, drives a horizontal Triumph ice machine, transmitting the power by means of rope-drive. A 100-horsepower motor driving in a similar manner a 30-ton horisontal ice machine was added about a year after. This is shown in Fig. 4, which also shows the flat covered tops of the freezing tanks to the left.

As the weight of the plates of ice formed is considerable, three traveling cranes, one for each row of tanks, are used for conveying the plate to cutting tables. Two 6-foot iron rods with eyes formed at the top are frozen into the ice and provide a means for lifting the plate from the tank and conveying it. These rods are later removed by applying a heavy current by means of a low-voltage transformer. Each crane has one 5-horsepower and one 3-horsepower, slip-ring, 220-volt induction motor. At the end of each row of tanks there is a cutting table which is tipped to a vertical or nearly vertical position to receive the ice and is then allowed to assume a horizontal position. A two-horsepower motor is used on each of these three tables. A circular saw, direct-driven by a 3-horsepower motor provided with a flexible connection, is used to cut the plate into cakes of 100 to 200 pounds each. These are pushed onto a chain conveyor which automatically carries them to the storage room or loading platform. This conveyor is operated by a two-horsepower motor. To give the attendants time to start all the motors properly after an interruption of current the Cataract Power & Conduit Company arranges to hold the circuit open after a momentary interruption for four minutes so that no damage can result.

This plant goes further than the Webster-Citizens Company in the abandoning of steam, as raw-water ice instead of distilled-water ice is made. No boilers, heaters, coal or engines of any kind are needed, Niagara power being employed for every machine. The building is of brick and concrete construction, and John Kellner, president of the company, says that it has been necessary to refuse new customers during the past half-year.

There is one other manufacturer of ice in Buffalo, but a steam-driven ice machine of 60 tons capacity is employed.

In Chicago there are several ice-making plants that have installed service from the Commonwealth Edison Company during the past year. The Lincoln Ice Company and Anderson & Goodman, aggregating almost 1,000 horsepower of connected load on 24-hour service, were the first two to adopt central-station power. They both used filtered raw water, agitated during freezing.

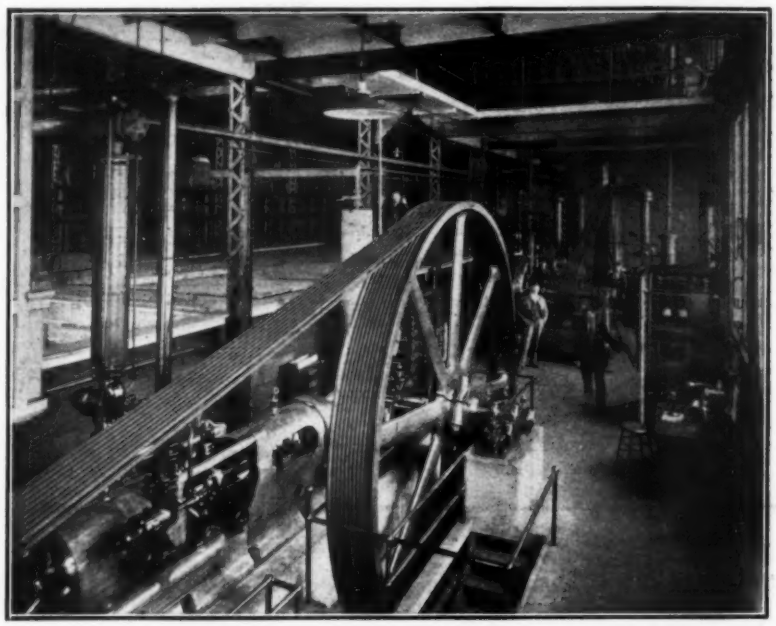


Fig. 4.—Freezing Tanks and Compressors, Crystal Ice Company.

The results obtained by the plants described in the foregoing indicate that the manufacture of ice is a well established business and that central-station power is advantageous to the ice plant and the latter a very desirable customer for the central station. The output of manufactured ice is steady, it is entirely independent of climatic conditions and the product is of uniform and good quality. The establishment of plants to serve various sections, as done by the Webster-Citizens Company, is an especially important factor to be noted by the central-station man, as this arrangement can best be served by central-station current.

The electric motor for the sewing machine will take 300,000 stitches for one cent's worth of current.

Fire Chiefs Meet in Denver.

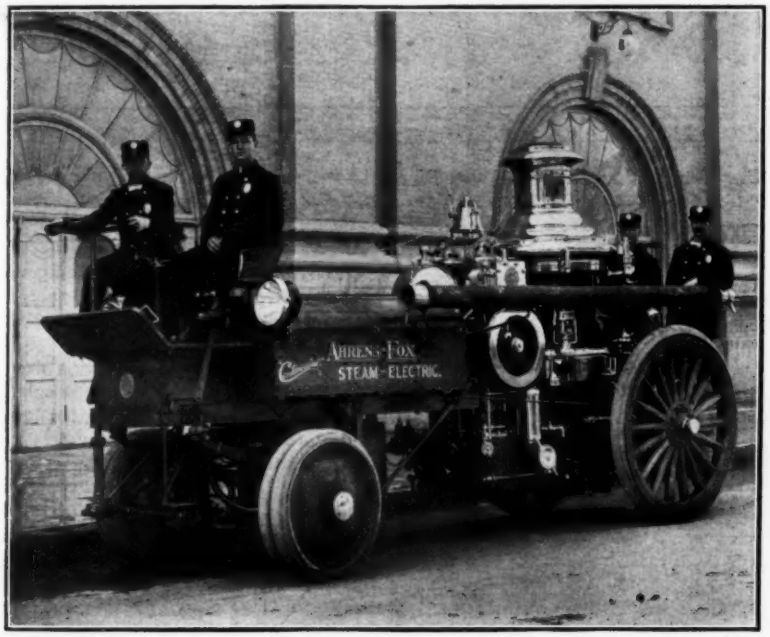
The annual convention of the International Association of Fire Engineers, an organization composed of the fire chiefs of the United States, Canada and other countries, was held in Denver, Colo., from September 15 to 20, and in honor of the occasion, Denver was decorated with a number of illuminating effects. The main thoroughfares were lighted with stringers suspended from the Tramway Company's poles, and Champa Street, which leads to the Auditorium, where an exhibition of modern fire fighting equipment was held, was a blaze of light.

In front of the Albany Hotel, on Seventeenth Street, an illusion depicting a fireman playing a stream of water on the hotel structure was worked out. This was a production of the Denver Gas & Electric Light Company's Illuminating Department and caused considerable comment among the visiting chiefs.

About 1,500 lamps were used to produce the illusion. In order to give action to the stream of water, a flasher was used and the animation was very realistic. The fireman's helmet was worked out in red lamps, while the stream of water, the outline of the body and the hose were brought out with ordinary clear-glass lamps. It was suspended from a cable stretching from the roof of the Albany Hotel, the headquarters of the chiefs, to the Equitable Building, directly across the street. Besides the fireman, a sign advertising the convention and the dates of the meeting was also erected.

Spectacular Sign in Denver During Convention of Fire Chiefs.

In connection with the exhibition of the fire apparatus in the Auditorium, the Ahrens-Fox Fire Engine Company, of Cincinnati, O., displayed an electrically propelled steam engine. This equipment was a converted horse-drawn affair and the change-over was made by simply attaching the electrical apparatus to the front end of the old steamer.



Electric Fire Engine Exhibited in Denver During Fire Chiefs' Convention.

The conversion of horse-drawn fire equipment by additions of this kind is being extensively done and it is said that eventually all fire-fighting machines will be electrically propelled. Cars of this type are being used in the service of the Springfield, Mass., fire department and have been giving excellent satisfaction, according to Chief Daggart, of Springfield, who was in attendance at the Denver meeting. The cost of running one of the steam engines in that city's service was $5.00 a month for a period of a year, or $60 for an entire year's service. Electric equipment has given the fire companies in that city a wider mileage radius and increased speed and it is safer and more reliable than any other kind of apparatus.

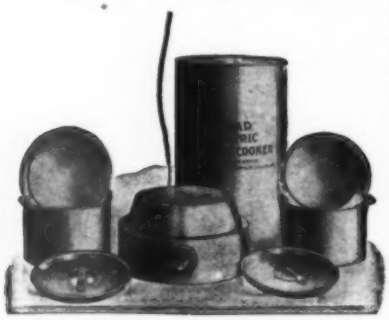
The machine exhibited in Denver has an 80-cell, 15-plate National battery and is capable of giving a speed of 18 miles an hour. The motors inclosed in the front wheels and are of 3.5 horsepower, geared seventeen to one. The controller is similar to that used on an electric trolley car, but is much smaller.

A demonstration of the machine while it was in Denver showed that it was capable of giving a speed of about 20 miles an hour, although the manufacturer claims a speed of only 18 miles an hour. It made a trip up Logan Hill, in Denver, which has a grade of about eight per cent, and a speed of eight miles an hour was made. The brake action on this car is on both the front and rear wheels.

New Electrical and Mechanical Appliances

The Quad Electric Stove and Fireless Cooker.

It has been felt by many who have studied the subject of electric cooking that, until special low rates can be obtained for electricity so used, the most rapid headway to its general introduction will be obtained by the exploitation of electric cooking devices employing the so-called fireless-cooker principle. Such electric cookers appeal particularly to the economical housewife who does her own cooking, because they consume a relatively small amount of electricity, they reduce the labor and drudgery (because they are automatic and work while the mistress is otherwise occupied), they produce the most savory and thoroughly cooked dishes, and they have the decided advantage over the ordinary fireless cooker in that they eliminate the separate preliminary heating and transfer to



The No. 1 Quad Equipment.

the cooker, since the initial heat needed is entirely produced and conserved in the cooker itself. Electric fireless cookers appeal to the central station because they popularize electric cooking in general and their load is essentially off-peak, since the current for the evening meal is applied several hours before the maximum lighting peak. All of these advantages have induced several manufacturers in the past year to develop electric fireless cookers of various sizes and types.

The A. L. Sykes Manufacturing Company, 114 West Pearl Street, Cincinnati, Ohio, has recently perfected its Quad electric stove and fireless cooker. This apparatus is really a complete but compact electric cooking outfit of high efficiency and of such reasonable price as to be within the reach of housekeepers of small homes and apartments. The equipment has a round base containing an electric stove and three-heat switch that may be used by itself as a disk stove for frying, toasting and miscellaneous cooking. The heating unit is a 600-watt iron-clad Westinghouse element that can be furnished for standard 110 volts or any other voltage desired; the heating element is entirely sealed and protected from moisture, grease, etc.

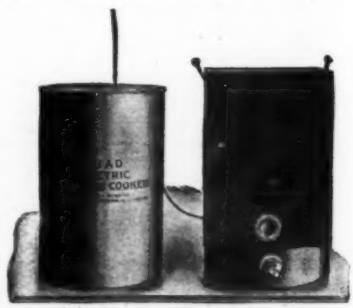
The upper edge of the base is deeply beveled. A thoroughly heat-insulated cover with correspondingly beveled lower inner edge can be placed over the base, thus forming a sealed heat-retaining chamber in which the fireless cooking goes on. The inside of the cover consists of a seamless aluminum lining that effectively protects the heat-insulating material from deterioration. There are no soldered or other joints to open and the lining is easily kept clean. On the outside the cover is finished either in blue steel of No. 27 gauge or in a durable nickel-plated steel specially imported from Germany. The effectiveness of the arrangement is shown from tests that prove that in the larger sizes of the Quad outfit a temperature of 429 degrees Fahrenheit is obtained with 30-minutes' application of the current. The heat-retaining powers are excellent; on touching the outside the heat can hardly be felt.

From two to seven durable aluminum cooking vessels are provided with each outfit. These are specially designed to closely fit the heating chamber. Two sizes of Quad equipment are made; the No. 1 size has a height of 23 inches and total capacity of 16 quarts; the No. 2 size is 18 inches high and has a total capacity of 8 quarts. The diameter of the plate in each case is 10 inches.

In place of the fireless-cooker cover an oven with a beveled open bottom can be fitted over the base, as shown in one of the illustrations herewith. The oven is lined with asbestos and has a hollow air space in its top and sides. The glass door permits one to see how the baking or roasting is going on without opening the door or jarring the contents. The three-heat switch permits good regulation of the current to various requirements. The oven has been found particularly serviceable for baking, although it is also successfully used for roasting; in connection with the latter it is found that the shrinkage of the meats is very small compared with that when roasting is done in gas or coal ranges.

An automatic time switch can also be supplied for use with the Quad equipment. It enables the mistress to merely put the food into the cooker, set the clock for a desired time, turn on the current and leave the outfit to take care of itself, since the switch is automatically opened at the time set. This gives an added convenience and prevents leaving the current on too long.

The Quad equipment is of special value in light housekeeping, as it dispenses with the need for a gas range or other objectionable cooking outfit. It also materially aids in the solution of the servant problem, as it facilitates the cooking work by relieving it of the tiresome watching by the stove; it makes it a pleasure for the mistress to attend to the cooking herself. Tests with the Quad outfit show that it can be used economically on a large scale; thus it can provide the entire cooking of three meals a day for a family of five to



Quad No. 2 With Interchangeable Oven.

seven persons with an energy consumption of 27 kilowatt-hours per month. The equipment may be connected to any ordinary lighting circuit, so long as no lamps are in use thereon at the same time as the full heat (600 watts) is supplied to the heater. The heating element is guaranteed for two years, if used at the proper voltage.

Navy Contracts Awarded.

The following contracts have been awarded by the Navy Department:

Vitrified clay conduit, Pearl Harbor, Western Electric Company, $4,601.93; 9,915 feet of three-conductor lead-covered cable, General Electric Company, $8,069.10; rubber-insulated cable, Pearl Harbor, Safety Insulated Wire & Cable Company, $2,317.50; 6,500 pounds weatherproof copper wire and cable, National Brass & Copper Tube Company, $1,226.75.

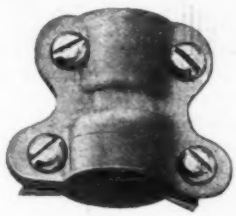
Ovalduct Conduit and Fittings.

In the design of office and loft buildings it is customary to lay out the wiring and outlets to what seem to be the logical requirements of the future tenants. It is very frequently necessary, however, to subdivide offices, rearrange rooms and partitions, and to change outlets and switches or provide additional outlets to suit the wishes of the actual tenants. Where the building is of fireproof construction and wired in rigid conduit, such alterations and extensions involve serious cutting of the tiling to provide large enough runways for the new conduit. To eliminate this objectionable practice the Steel City Electric Company, of Pittsburgh, Pa., has placed on the market a steel conduit of elliptical cross-section, known

Ovalduct Coupling.

by the trade name Ovalduct. In the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of March 23, 1912, the use of this conduit in the new Insurance Exchange Building, Chicago, was described and illustrated. This article will dwell chiefly on the fittings suited to Ovalduct.

The new conduit itself is made of one-sixteenth-inch seamless drawn elliptical steel tubing with three-eighths-inch as the shorter diameter and five-eighths-inch as the longer one. The conduit is thoroughly sherardized in-



Ovalduct Adapter.

side and outside and then it is enameled inside, thus giving a smooth, well protected interior surface. Duplex wire is readily pulled in or withdrawn. The conduit may be bent as easily as rigid circular tubing where the conditions require it. In using Ovalduct for extensions it is not necessary to chip the tiling at all, since it is readily clamped or wired to the under surface of the same and then plastered over, thus making the entire job a concealed conduit installation.

A special line of fittings has been developed for use with Ovalduct. These include elbows, outlet boxes, bushings, couplings and adapters. The ceiling or outlet boxes have five circular half-inch knockouts for round conduit in the bottom and six oval knockouts in the side to fit Ovalduct. The bushings for securing straight Ovalduct or elbows to the sides are quickly tightened to the bottom of the box without even removing a screw. A special coupling for joining lengths of Ovalduct is installed by merely tightening two screws. An ingenious adapter has been developed for connecting Ovalduct to standard round conduit. At one end it is threaded for round pipe and at the other it forms an elliptical bushing or clamp. All the fittings are sherardized to render them rustproof.

The Easy Motor Washer.

The manifold advantages of the electric washing machine for the home have won for it a permanent place in the list of modern labor-saving devices. The demand for it has resulted in a number of different designs being placed on the market, it being the idea of the designers to secure a machine that would do the work quickly, economically, and at the same time without damaging the material to be washed. The machine illustrated herewith accomplishes this three-fold purpose in a very novel but efficient manner.

The principle of washing consists in forcing the soap suds through the clothes, accomplished, before the advent of the washing machine, by rubbing the clothes against a board. This machine utilizes the above principle by means of an electric motor which raises and lowers rustproof metal funnels or basins through the soapy water. These basins are attached to a yoke which is in turn fastened to a center bar by thumb screws. The bar is backed up by a compression spring that automatically adjusts the position of the basins according to the amount of clothes in the machine. The electric motor is mounted on the frame under the wash pan in an accessible place from which it may easily be detached.

The motor is belted to the main driving shaft that carries a pinion which engages a spur gear, and this in turn operates a lever by means of a crank and connecting rod. One end of this lever is pivoted on the framework of the machine, and the other attached to the piston rod carrying the suction basins, giving it a reciprocating motion in a vertical direction. A tension spring, that is connected to the frame of the machine, and the lever assist in lifting the basins on the up stroke. As they reach the limit of each upward stroke, a ratchet automatically operates on a wheel attached to the piston rod to turn the basins to a new position for each downward stroke.

The machine operates at 60 revolutions or reciprocations per minute, a speed considerably in excess of that attained by any other machine on the market without spattering to an objectionable extent. In this operation there have been accomplished the desired object—that of covering the clothes systematically, and producing so great an agitation of water by the harmless, frictionless pressure of air by the basins that the most soiled clothing cannot escape being cleaned, and the most delicate piece of fabric cannot possibly be injured.

The machine is equipped with a wringer, which is also operated by the electric motor through a set of silent, inclosed bevel gears. The pow-

Easy Motor-Driven Washer.

er is transferred from the washer basins by a clutch lever conveniently located near the bottom of the tub. This lever can be operated to transfer the power from wringer to washer and vice versa without stopping the motor. The wringer can be reversed by a small lever located near the upper roll.

The tub or tank is made of cold-rolled, double-seamed copper; it has a diameter of 24 inches, and is about 19 inches high. The bottom is reinforced by a plate of galvanized steel and stiffened by a bar of channel steel.

A gas burner for heating the water is also attached to the frame of the washer under the bottom of the tank. This device will heat the usual quantity of water to the scalding point in from 20 to 30 minutes.

The entire machine is mounted on

channel-steel legs and roller-bearing casters; it weighs about 130 pounds and can be conveniently wheeled about the floor. It is known as the "Easy" motor washer and is manufactured by Dodge & Zuill, Syracuse, N. Y., who guarantee it for three years. The Westinghouse motor used has a capacity of one-eighth horsepower at 700 revolutions per minute. As above stated, it may easily be detached and is, therefore, made available for many other household uses, such as operating the ice-cream freezer, vacuum cleaner, food chopper, knife polisher, etc.

Cutler-Hammer Five-Inch Regulator.

The many uses for a regulator with small motors, electric heating devices, etc., have made place for a regulating device still smaller than the standard six-inch regulator. The accompanying illustration shows a new five-inch regulator placed on the market by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis., Three

Five-Inch Regulator.

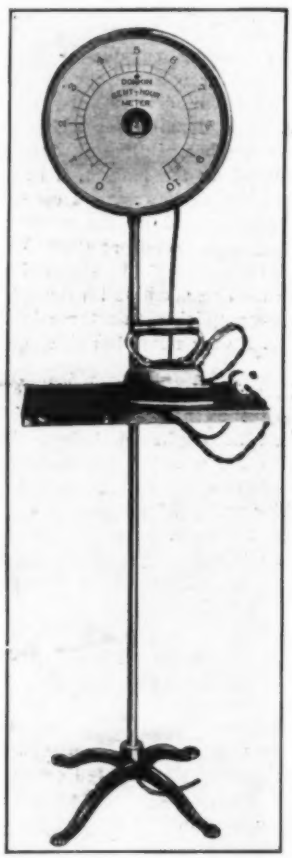
current adjustments are provided and an "off" point, operation being by means of the small lever extending from the back of the inclosing case. This lever is so arranged that it sets squarely over the contacts which are mounted on the back of the porcelain base. A protecting cement completely covers the resistance material and a black japanned metal case incloses and protects the entire unit. It has a dissipating capacity of 60 watts and can be provided with a total resistance of 1,200 ohms maximum.

A Meter that Shows Cost of Operating Electrical Devices.

A new meter intended for use in the central-station display room has been put on the market by the Harbrook Service Company, of Pittsburgh, Pa. The meter, called the Donkin cent-hour meter, is the invention of William A. Donkin, contract agent of the Allegheny County Light Company, Pittsburgh, Pa.

Its purpose is to give an authoritative answer to the universal question "How much does it cost to operate?" When any current-consuming device is connected to the meter, the hand points instantly to the number of cents per hour that it costs to operate. It is especially useful in demonstrating to a customer the cost of current for a device that operates at more than one heat.

The meters are calibrated and the reading of the dial is made to correspond to the central station's rate. The



Cent-Hour Meter and Stand.

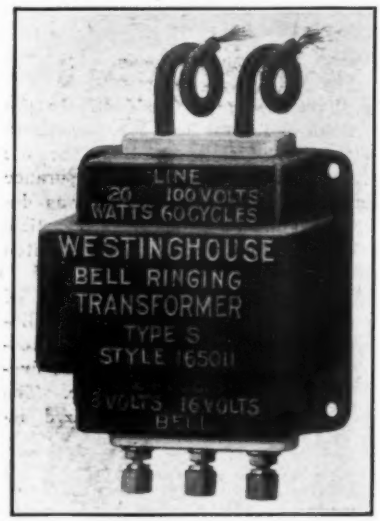
mechanism is similar to that of a regular indicating wattmeter, but is simpler in construction.

The Doukin cent-hour meter is mounted on a floor pedestal and is provided with a stand to hold the device being measured for current consumption. It has been shown by actual test that this method of answering the all-important question has more weight with the customer than a verbal answer and that the cent-hour meter is an important factor in making sales.

Westinghouse Bell-Ringing Transformer.

The use of bell-ringing transformers has become so popular that the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has placed on the market a new transformer of this type, built according to the design of its well-known type-S distributing transformer. It is very light in weight, compact in size, absolutely fireproof, and practically indestructible. The fact that it possesses such characteristics enables it to be mounted in any out of the way place, as it requires no attention whatever after its installation and should last a life time. It will deliver an open circuit 8, 16 or 24 volts, depending on the connections. It is particularly useful for apartment houses and public buildings.

The coils and magnetic circuit are vacuum dried and impregnated with a moisture-proof insulating compound. After this treatment the complete unit is fitted into its case. The interior of the case



Small Type S Transformer.

is then filled with a specially treated cement with the result that the coils and iron are completely imbedded in a fireproof and indestructible compound, which precludes any possibility of the bell-ringing circuit coming in contact with the 110-volt circuit.

Rubber-covered primary leads are brought out of the top of the case through a porcelain bushing and are left of sufficient length to permit connection to the lighting circuit. Binding posts are provided, as shown in the illustration, for the bell circuit. The fastening lugs are so arranged that an air space is provided between transformer and wall.

A test of 2,500 volts for one minute is applied between the primary windings and the secondary winding and case. The transformer will stand a dead short-circuit continuously on the bell-ringing side without injury.

A Boiler-Efficiency Meter.

It has long been known that the actual every-day efficiency of the average steam-boiler plant is very much less than can be attained when the furnace and boiler are properly operated and maintained. The results of lax boiler-room practice are great waste of fuel, excessive smoke production and unstable steam pressure. This is largely accounted for by the unskilled class of labor available at the low scale of wages prevailing for fireman, the complexity of the furnace reactions and the absence of a simple instrument to act as an indicator of the changes taking place.

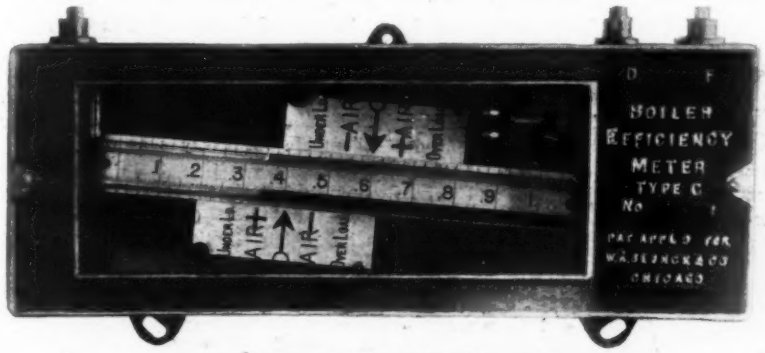


Fig. 1.—General View of the Instrument.

It is true that the CO_2 recorder, the steam-flow meter and the draft gauge are material aids in this direction, but the first two of these instruments are expensive in first cost and by no means easy of interpretation by the average fireman. To combine the advantages of these three instruments in one simple indicator that will show the condition of the fire without opening the doors to observe it, W. A. Blonck, consulting engineer, 404 Fisher Building, Chicago, has invented what he terms a boiler-efficiency meter, on which patents are pending. This new instrument is very simple, compact and relatively inexpensive in construction, and it is easy to read and understand its indications.

The instrument consists essentially of two draft gauges, each having one tube slightly inclined above the horizontal to give large divisions to the scale between them; this scale is 10 inches long. As shown in Figs. 1 and 2, above the upper tube and also beneath the lower tube is an adjustable scale or indicator with an arrow, plus and minus signs and other simple markings. These sliding scales are set when the instrument is calibrated at the time it is installed, the arrows in each case pointing to the normal readings for the particular boiler. Each tube contains a colored non-volatile oil, the upper one blue and the lower one red. The lower tube is connected at the left with the atmosphere and at the right with the furnace just above the grate; it measures the furnace draft. The upper tube has its left end connected to the furnace also, and its right end to the boiler side of the damper; it measures the draft through or around the boiler tubes and smoke passages.

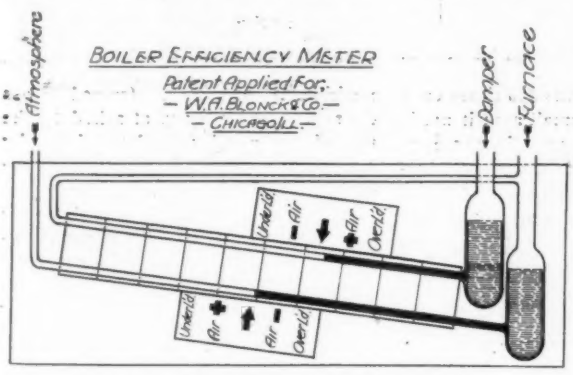


Fig. 2.—Arrangement of the Draft Tubes.

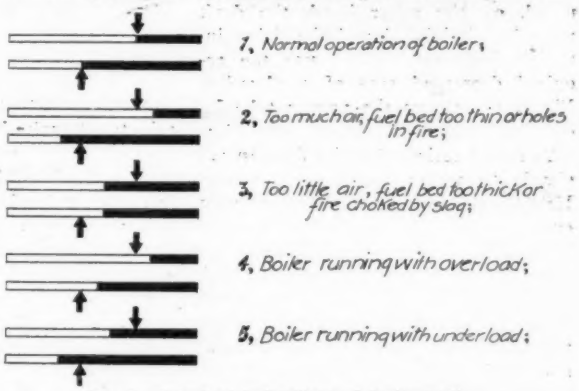

1, Normal operation of boiler;
2, Too much air, fuel bed too thin or holes in fire;
3, Too little air, fuel bed too thick or fire choked by slag;
4, Boiler running with overload;
5, Boiler running with underload;

Fig. 3.—Principal Indications of Instrument.

The sum of the two readings represents the total draft through the furnace and boiler. For the normal settings this sum is 1.0 inch. The instrument is mounted in an iron case to protect it from injury.

To understand the theory of the instrument it is well to remember that draft is the difference between static pressure at two points and that, according to some formulas, the draft needed to move a body of air or gas varies directly as the resistance to be overcome and as the square of the velocity of the gas or its rate of flow; thus the relation is quite similar to the potential difference in a simple electrical circuit which, of course, equals I^2R. Now through or around the boiler tubes, arches, baffle plates, etc., the gases meet with practically constant resistance (aside from the gradual accumulation of soot), consequently the draft from the furnace to the damper depends almost entirely on the quantity of gas passing; since the upper tube in the Blonck meter measures this draft, its reading is proportional to the quantity of gas or rate of flow. Through the grate and bed of fuel on the grate, however, the resistance is quite variable since it depends on the thickness of the bed, the presence of clinkers or slag choking up the interstices of the grate and fuel bed, the presence of bare spots on the grate, etc. The draft through the grate and fuel bed is therefore affected much more by this variation of resistance than by changes in the quantity of air passing through the fire; since the lower tube in the Blonck instrument measures this draft, its reading is chiefly affected by the resistance through the furnace.

These statements are verified by actual observation of the two tubes. Fig. 3 shows the five principal indications of the instrument and the boiler and furnace conditions corresponding thereto. In adjusting the instrument for the normal settings, the boiler and furnace are first put under normal condition as to steam pressure, boiler load, cleanliness of grate, thickness of fuel, etc., so as to reproduce as perfect steaming and fire conditions as possible. By means of a flue-gas analyzer the condition of the gases is determined and when the maximum percentage of CO_2 is obtained readings of the tubes on the boiler-efficiency meter are taken and the arrows of the

indicators adjusted thereto. The instrument is then sealed.

Whenever the liquids in the tubes stand as shown in Fig. 3 (1) this indicates the normal condition of boiler and furnace, which is the ideal the fireman should attempt to maintain. With boiler load and fire normal the damper is adjusted to bring this about. If the damper remains unchanged and the fuel bed is allowed to get too thin or even bare spots to develop on the grate, the furnace resistance decreases and much excess air is admitted; this is the condition represented by Fig. 3 (2), wherein the decreased reading of the lower tube and the increased reading of the upper tube indicate a decrease in furnace resistance and an increase in flow of gas. This is a very wasteful condition, as the excess air admitted carries away many useful heat units; the remedy is evidently immediate refiring to cover the grate uniformly to the proper depth. On the other hand, if too much coal is thrown in or clinkers and slag allowed to accumulate on the grate, the fire will be choked, that is, the furnace resistance increased and too little air admitted. This condition is indicated by Fig. 3 (3); when the fireman observes such readings on the instrument tubes he must immediately clean his fire. If the boiler is steaming heavily, an increased rate of combustion is required. This calls for more air (by readjustment of damper) and more frequent firing and is the condition shown in Fig. 3 (4), which gives the proper relative indications of the tubes for an overload. If the boiler is supplying only a small demand, on the other hand, the draft must be diminished and the firing intervals increased to produce the required decreased rate of combustion. Fig. 3 (5) shows the proper tube indications for an underload condition.

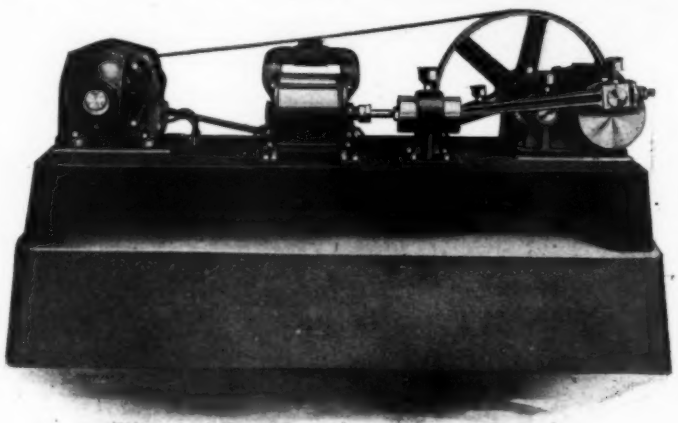
These directions for the fireman are simple to understand and to follow. He does not have to open the fire door every little while to see how the fire is burning. This old practice is the cause of much low efficiency, since it permits the introduction of too much cold air. When he does have to open the fire door for cleaning or firing, he should check the dampers. The Blonck instrument is a very sensitive one. A deviation from its normal readings of only 0.1 inch either way represents a decided decrease of CO_2 in the flue gases and a deviation of as much as 0.2 inch has been found to represent a decrease of CO_2 to only about one-half of its best value. Its use is adaptable to both hand fired and mechanically stoked furnaces and any type of boiler. It should bring about a material increase in efficiency.

The Universal Stationary Vacuum Cleaner.

An interesting type of stationary vacuum cleaner for which is claimed high efficiency at low cost has been placed on the market by the Universal Vacuum Cleaner Company, of Jackson, Mich. This cleaner has several distinctive features. It has a piston pump driven by a General Electric motor through belt and gearing. This pump is capable of producing a vacuum of 22 inches with the intake shut off. The piston works to within one-quarter inch of both the intake and exhaust valves. The motor can be started and stopped by means of a switch near the wall connections.

A most important feature of the Universal system is in placing its dust collector and separator in the room where the cleaning is done. The collector is made of aluminum and weighs only six pounds. It is very compact and easy to handle. The separator has a vibrator that beats 520 times each minute. Despite its small area it needs to be emptied only once in three or four weeks in ordinary household service. Several advantages result from this arrangement. The dust and dirt are carried only a very short distance, compared to what is necessary when the collector is installed in the basement. The danger of clogging the fixed piping is entirely removed; this piping is much smaller than is the case when all the dust must be carried a long distance and the pump works more efficiently because the displacement is smaller. All these advantages result in a higher working vacuum at the point where the cleaning is done.

The most common size of Universal cleaner is designed for private homes; it has ample capacity to care for seven or eight-family apartment buildings. A larger size is made for churches, clubs, halls and other public buildings. The largest size is for commercial service. Each outfit includes a full assortment of cleaning tools and appurtenances.



Universal Vacuum Cleaner, Stationary Type.

Waverley Electric Sheltered Roadster.

The Waverley Company, of Indianapolis, Ind., has originated a new design of electric runabout known as the sheltered roadster. This car is designed after the fashion of the gasoline roadster, but with many improvements of body design not as yet incorporated in any other roadster.

The chief feature of this Waverley model is the combined landau and open roadster top effect. This top may be easily converted from one to the other, making possible a car adaptable for every season.

When converting from open roadster to landau the top is pulled forward and up in the regular way, the wind shield is lifted from its lower position, two regular framed glass doors or windows are attached to the top of the regular roadster doors by means of two thumb screws that are entirely invisible when in place. Behind these doors are buttoned to the top heavy leather side curtains as used in regular landau body construction, entirely housing in all the occupants of the car in the same manner as the coupe. The doors open and close from top to bottom in the same manner as in the coupe or limousine.

The new Waverley roadster accommodates three persons. The body is long, deep and wide. The back of the seat is extremely high, while the seat cushions are thick and deep. On account of its full elliptic springs all around, this is a very easy riding car. It has a speed of greater than 25 miles an hour and being lightly built, a greater mileage is said to be possible than from other electric closed cars.

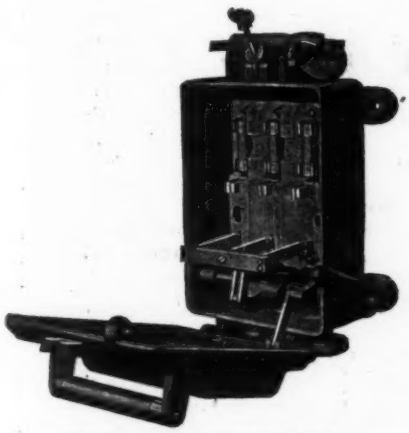
New D & W Fused Switch Boxes.

A new line of combined fuses and switch boxes has been placed on the market by the D & W Fuse Company, of Providence, R. I. These boxes are intended for 250-volt direct-current circuits and are particularly designed for severe mill service. They may be permanently locked after inserting the fuses to prevent tampering or unauthorized increase in size of fuses. Opening the cover opens the switch also, thus making it impossible to replace a fuse when

Switch Box Locked.

the switch is open. The lever at the side of the box opens and closes the switch independently of the cover.

The construction of the boxes and switch mechanism is strong and simple. Rubber gaskets around the cover make the box waterproof. Removable porce-



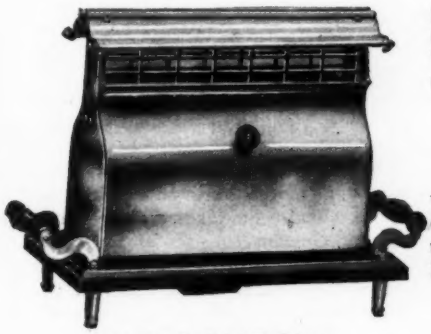
Box Open for Replacing Fuses.

lain bushings facilitate connection to heavy cables. The switches are made double-pole or triple-pole and the sizes run up to 100 amperes.

The Helion Radiant Toaster.

A new radiant toaster, which has found favor in view of its many improvements in design and advantages in operation, has recently been placed on the market by the Helion Electric Company, of Newark, N. J. The toaster is equipped with four straight Helion units, which are brought to an almost white glow when the current is turned on. The toaster is highly finished in nickel, has a rack on top for holding finished toast, and two hinged doors at the sides to keep the toast in close proximity to the heating units. It is equipped with a cast-metal base and a six-foot silk cord with plug. The legs, made of insulating material, are sufficiently long to prevent the heat from the toaster from scorching the table.

The Helion resistance material will



Helion Radiant Toaster.

stand a temperature of 3,100 degrees Fahrenheit, without any permanent change in its physical, chemical or electrical characteristics. It operates in the open air, and cannot be injured by dirt, wind or water.

A General Alarm for Telephone Systems.

In manufacturing plants, public buildings and schools or other institutions

General Telephone Alarm Equipment.

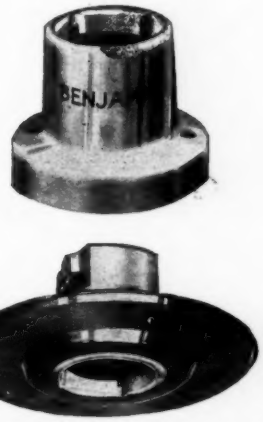
which have private telephone systems or are planning to have such a system there is frequently need for a device which will ring a number of bells or buzzers simultaneously. Such a device has been perfected by the Western Electric Company in what are termed general-alarm or code-signaling sets.

The functions of the sets, which will probably find their greatest application in connection with private-branch exchanges and interphone systems in business houses, factories, hospitals and schools, will be to call to the nearest telephone any one of a number of men by an arbitrary selective code, to sound an alarm in case of fire or other emergency, and to sound bells for recess or recitation periods. The sets may also be used independently of telephone systems.

The signaling set may be mounted at any central point and bells and buzzers scattered wherever signals are to be given. A simple turn of a key handle will sound a call simultaneously on all the bells and repeat the call four times, each key sending out a different code signal. The sets can be connected into the telephone or interphone system, together with an auxiliary resistance and condenser box. They are furnished in any capacity up to ten different signals.

Benjamin Car Receptacles.

Two new receptacles of particular value in car wiring have been placed on the market by the Benjamin Electric Manufacturing Company, Chicago, Ill. Fig. 1 shows a two-piece porce-



Figs. 1 and 2.—Benjamin Car Receptacles.

lain wall receptacle with concealed binding terminals and the Benjamin lamp grip recently described in these columns. This receptacle may be furnished with a close-fitting 2.3125-inch brass cover or a looser one of 3.25-inch size. In Fig. 2 is shown a special receptacle designed for places where the lamp socket or receptacle is desired to be practically flush with the wall or ceiling surface. It is particularly valuable in securing to outlet boxes where conduit wiring is employed. This receptacle also is provided with the Benjamin lamp grip. Each receptacle has a double cover; the inner one is a steel plate to which the receptacle is attached and which serves as a cover for the outlet box, these covers being made either for 3-inch or 4-inch boxes; to the steel plate or inner cover is fastened by two screws an outer brass cover.

Five New Edison Mazda Lamps.

For 100-130-Volt Circuits.—Previously the only round-bulb Edison Mazda lamps available for this circuit were the 15, 25, 40, 60, 400 and 500-watt sizes. On October 1, the General Electric Company added two new intermediate sizes, namely the 100-watt and 150-watt sizes. This addition gives the user nearly the same wide range of sizes as now available in the standard, or pear shaped, bulbs.

Concentrated - Light - Source Mazda Lamp.—Another new lamp, whose successful production marks a decided advance in the manufacture of metallic-filament lamps, is the concentrated-light-source Edison Mazda lamp, also standardized October first. This lamp is equipped with a concentrated filament and will be used on 100-130-volt circuits wherever a concentrated light source is desired, especially in projecting machines in homes and for general advertising purposes. The difficulties overcome in designing this lamp can be appreciated when one considers that a standard straight-bulb Mazda lamp for this voltage would require a filament approximately three feet long. In order to obtain the necessary concentrated light source in the new lamp, this length of drawn-wire filament is formed into a helix of small diameter somewhat resembling a closely coiled spring. This "spring" is then mounted or coiled together in a space approximately one-half-inch each way, thus giving a very concentrated source. The lamp operates at the high efficiency of 1.23 watts per mean horizontal candlepower. It is designed to give a life of approximately 250 hours at rated efficiency. The round bulb, known as the G-30, is 3.75 inches in diameter and 6.125 inches over all. Because of its concentrated source, this lamp is especially adapted for use with either a parabolic reflector or a lens in projecting machines and for advertising purposes.

For 200-260-Volt Circuits.—Formerly the only round-bulb Edison Mazda lamps available for this circuit were the 40 and 60-watt sizes. On October 1 the General Electric Company added two other sizes, namely the 25-watt and 100-watt. Where round-bulb lamps of this voltage are required the addition of two new sizes gives users a widely useful range of sizes from 25 to 100 watts inclusive.

Panama Contracts Awarded.

The Panama Canal Commission has announced the award of a contract to the General Electric Company for gate-moving machinery and motor, at $12,568.50; for electric cable to the Waterbury Company, 210,000 feet at $24.23 per thousand; for 50,000 feet No. 6 B & S. gauge to the National India Rubber Company, Bristol, R. I., at $82.26 per thousand, for 38,000 feet No. 10 B & S gauge at $50.07 per thousand, 134,000 feet No. 6 B & S gauge single conductor cable at $50.17 per thousand, 164,000 feet No. 10, $26.87 per thousand, and 150,000 feet No. 12, at $21.73 per thousand.

4,000 feet of No. 6 B & S single-conductor; varnished-cambric-insulated cable will be supplied by the General Electric Company at $60.20 per thousand.

Pelouze Electric Toaster.

A new electric toaster has been placed on the market by the Pelouze Manufacturing Company, 232 East Ohio Street, Chicago. As shown in the illustration, it is of unusually artistic design and attractively finished with a high nickel polish, thus harmonizing more thoroughly with the usual dining-room equipments. The heating element consists of resistance wire wound around vertical lavite tubes, the winding being closer at the bottom than top so as to give more heat below than customary. The result is a very uniform effective heat which means that the toast is evenly

Pelouze Electric Toaster.

browned all over each surface. The heating element takes 550 watts at standard voltage. The toast is made with unusual speed. On top of the toaster is a warming tray both for preliminary drying of the bread before toasting and for keeping the toasted bread warm until used.

The Portland (Ore.) Railway, Light & Power Company has recently placed an order with the Western Electric Company for apparatus to be used in equipping its electric interurban railroad lines with telephone train-dispatching equipment. One division to be equipped extends from Portland to Cazadero, Ore., a distance of approximately 40 miles, while the other is the Mount Hood division, about 30 miles. Seventeen way stations will be equipped at present and ultimately 36.

Professor Hannover's New High-Capacity Lead Storage-Battery Plate.

Mention was made in these columns last spring (April 20, 1912; page 764) of the invention by H. I. Hannover, of the Danish Polytechnical High School, Copenhagen, Denmark, of a new process for making lead storage-battery plates so porous as to give them an extraordinarily high capacity. Further particulars in regard to this have just become available and for these we are indebted to *Electrical Engineering*, of London.

In the manufacture of the plates the professor makes use of the properties of what is known as the "eutectic" alloy of lead and antimony. When an alloy containing a greater percentage of lead than of antimony is melted and allowed to solidify, a microscopic examination shows that the lead first solidifies in the form of crystals gradually growing in size, leaving spaces between them filled with an alloy which solidifies at a lower temperature. As soon as the temperature drops to 228 degrees centigrade, the remaining metal, which has the proportion of 87 of lead to 13 of antimony, and is the so-called "eutectic" alloy, solidifies simultaneously. Thus, in the case of a lead-antimony alloy containing 4 per cent of the latter metal, 69 per cent of the plate will be pure lead, and it will contain minute holes filled with an alloy formed by the remaining 27 per cent of lead and 4 per cent of antimony. If such a plate be reheated to 228 degrees centigrade, this alloy will melt, and can be expelled, leaving a lead plate pierced with innumerable holes of microscopic dimensions.

It is on this principle that the plates of the Hannover accumulator are made. Theoretically, all the antimony should be expelled, but in practice a small amount remains, and this, while not having any effect on the capacity, somewhat strengthens the plate.

Several methods were tried as a means of expelling the eutectic alloy. These included the use of oil under pressure, compressed carbon dioxide, and also simply heating the plate and shaking out the alloy, but apparently the method which gave the best results was to revolve the plate so that the material was expelled by centrifugal force. It was found necessary to strengthen the plate, and to clamp it in such a way that it did not crack during the process. By varying the composition of the initial alloy, the temperature and the velocity of rotation, plates of varying degrees of porosity could be obtained. For instance, the stronger the plate was heated, the greater was the amount of lead that melted out with the eutectic alloy.

We look forward confidently to further developments in the practical manufacture of the plates, made in accordance with Professor Hannover's discovery.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

CANISTOTA, S. D.—An electric light system is to be installed at this place.

MAYVILLE, N. D.—The city has decided to install a new electric light plant to cost about $20,000. C.

KELSO, WASH.—The Independent Electric Company has been granted a franchise in Cowlitz County.

FAIRBURY, ILL.—The Central Illinois Utilities Company has been granted a 30-year franchise by the City Council. Z.

CAMBRIDGE, MASS.—The Committee on Wires and Lamps is agitating a municipal electric lighting plant for this city.

ROLFE, IOWA.—The Northern Iowa Power Company of Humbolt will build a transmission line here and furnish light and power. C.

GLIDDEN, IOWA.—An electric light plant will be installed here and possibly transmission lines will be run to Ralston and Scranton. C.

PRESCOTT, ARIZ.—The Climax Mining Company plans to install a power plant at the mines and run a transmission line from this place.

CHATHAM, N. J.—At a special election it was decided to issue bonds for $35,000 for additions to the municipal electric lighting and water plants.

RIVERSIDE, CAL.—The Southern Sierras Power Company is investigating the matter of stringing high-power mains throughout the Yucaipa Valley.

KEARNEY, NEB.—Plans are being made by the Oscar Claussen Engineering Company, St. Paul, for an electric light and water power plant to cost $90,000. C.

NORFOLK, NEB.—The directors of the Commercial Club and the city officials have under consideration the cluster-light system for certain parts of this city.

ALABAMA CITY, ALA.—The Alabama Power Development Company has been granted a franchise to enter this city and transmission lines will be built at once.

NEWARK, N. J.—The Shade Tree Commission, of which Carl Bannwart is secretary, has decided to install cluster standards in the needed sections of the city parks. A.

KENDALLVILLE, IND.—The City Council is asking for bids for one Corliss and a belted united or two Corliss engines to be installed in the municipal electric light plant. S.

MANSFIELD, MO.—The Mansfield Light & Power Company has been incorporated with a capital stock of $10,000 by F. B. Fuson, M. W. Oliver and Perry Simmons.

HEARNE, TEX.—Bids are being asked for installing an electric light system in Hearne. It is reported that the new system will be installed within the next few months.

HOLBROOK, MASS.—The selectmen have granted the Randolph & Holbrook Electric Light Company a permit to erect poles and attach wires thereto on Central Street in this town.

DECATUR, ALA.—Carl C. Wilson, of Anniston, is promoting the "White Way" system of lighting for Decatur, and it is probable that there will be a "Great White Way" between Decatur and New Decatur.

OSEOLA, IOWA.—Gilbert Johnson, who has a contract to sell light and power in Murray, Iowa, and is running a transmission line from this city, will begin the construction of a distributing system. Z.

SAN FRANCISCO, CAL.—Articles of incorporation have been filed for the Wizard Electric Company, with a capitalization of $25,000, by C. M. Claussen, W. A. McKay, W. F. Rose, M. Claussen and L. Krull.

CHATTANOOGA, TENN.—A. N. Sloan, Commissioner of the Department of Streets and Sewers, is receiving estimates from engineers upon the cost of installing a municipal conduit system for electric wires in this city.

SHERIDAN, IND.—The Town Board has repurchased from L. M. Vickery the electric light plant sold to him two years ago, and will endeavor to make municipal lighting pay. The Board has some improvements in view. S.

SPRINGFIELD, MASS.—The Boston & Albany Railroad is planning the construction of a $30,000 addition to its power plant. The addition will contain four new boilers of 150-horsepower capacity and a new air compressor.

MOUNT STERLING, KY.—County Judge G. A. McCormick and County Attorney Early Senff are arranging to have the dial of the court-house clock illumined with electric lights. The work will be contracted for in the immediate future. G.

CRIPPLE CREEK, COLO.—It is probable that the Cripple Creek Drainage & Tunnel Company, which drove the Roosevelt deep tunnel, will erect a plant near the portal of that work and utilize the water power for the generating of electricity for the mines.

SAN BERNARDINO, CAL.—The Arrowhead Reservoir & Power Company is preparing to issue bonds in the amount of $4,000,000 to finance the completion of the dam at Little Bear Valley, the dam at Grass Valley and other extensions of its water systems.

MATTOON, ILL.—The Village Council at Windsor has granted a 50-year franchise to the Central Illinois Public Service Company, of this city, to build a transmission line to supply electrical energy. A five-year contract for lighting streets also has been made.

MACOPIN, N. J.—The Board of Works, Newark, which has a watershed in this section, is considering the installation of a hydroelectric power plant for local lighting and power purposes. Mr. Sherrerd, chief engineer of the Board, is engaged in the proposition. A.

DIXON, ILL.—It has been announced that the Northern Utilities Company will build a power plant to cost $1,000,000 in Dixon. The plant will furnish power to more than 30 cities and villages in Northern Illinois, where the company now has power stations.

SRINGFIELD, O.—The city officials and the Commercial Club are discussing the feasibility of changing the street lighting system in the central portion of the city, substituting cluster lights for the arc lamps. It is expected to perfect the plans for this improvement in the near future.

HARVARD, NEB.—The Village Council has granted a 20-year franchise to Elmer L. Jensen for the construction and maintenance of an electric light plant. It is planned to construct a plant which is adequate to supply 24-hour service and it is estimated that the cost will be $7,000.

CARROLLTON, ILL.—The Central Illinois Public Service Company will build transmission lines to Kane, Jerseyville, Roodhouse and Eldred, in addition to rebuilding the plant and pole and wire lines in this city and supplying pumping stations in Illinois River drainage district with electrical energy. Z.

PORTLAND, ORE.—The Pacific Power & Light Company has decided to build a large dam across the Columbia River at Priest Rapids to develop 75,000 or 100,000 horsepower. It is stated that the company is proceeding on a well developed plant to carry out this project, definite surveys having been completed.

FRANKFORT, KY.—A maximum limit of indebtedness of $7,000,000 is specified for the Kentucky Utilities Company in amended articles of incorporation which have been filed with the Secretary of State. The company is a new one which has merged a number of central stations in smaller Kentucky cities under one management.

NEWARK, N. J.—The Board of Works has passed a resolution requesting the Common Council to authorize a bond issue of $650,000 for the construction of a combination garbage-incineration and electric-lighting plant in the Salt Meadows, near Newark. The incinerator plant is estimated to cost $400,000 and the generating plant $250,000. A.

OROVILLE, CAL.—The Deer Creek

Power Company has been incorporated with a capital stock of $1,000,000. Those named among the stockholders are Martin C. Polk, C. L. Crowder, T. H. Polk, Park Henshaw, all of Chico. The company is formed for the purpose of engaging in the business of developing electric power for lighting and other purposes.

KNOXVILLE, TENN.—The Business Men's Club is now considering plans for the extension of the Market Square ornamental system of lighting along Prince Street. The Prince Street merchants have voted unanimously to assume the cost of maintaining the lighting improvement as soon as the Club can complete arrangements for the work. G.

HARRISBURG, PA.—Charters have been granted to two new lighting companies in this state, each having a capital stock of $5,000. One is the Daisytown Electric Company of Daisytown and the other the Middle Taylor Township Light & Power Company. The incorporators of these companies are P. J. Morrisey, August Weis and J. W. Blough, of Johnstown.

DOVER, N. J.—The Board of Water Commissioners has been empowered to purchase a steam-pumping plant for the town water system. The proposed plant will comprise a 150-horsepower boiler of marine type, cross-compound pumping engine, surface condenser, boiler feed and air pumps, and accessories. The plant is estimated to cost about $8,600. A.

ELIZABETH, N. J.—A Council Committee composed of Frederick Bruchlacher, Otto Kitzler, Harry Kopp, A. H. Kent and James L. Butler, has in hand a proposition from the Public Service Electric Company to spend $60,000 during the first year in which a contract, which is being negotiated for with the city, becomes effective, for the construction of conduits and the removal of overhead wires.

NEW ALBANY, IND.—This city is to have up-to-date street-lighting facilities, consisting of ornamental bronze standards topped with tungsten globes, as soon as an ordinance in the hands of the City Council is passed. This measure will authorize the Federal Electric Sign System to erect and maintain the standards throughout the retail business district of this prosperous Indiana city. G.

KANSAS CITY, MO.—The mayor of this city has in hand negotiations to issue $2,000,000 worth of bonds for the purpose of erecting poles and wires and going into the business of supplying electricity for light and power, the electricity to be purchased from the municipally conducted electric light plant of Kansas City, Kan., in which case the plant at Kansas City, Kan., will, in all probability, be greatly enlarged.

GARDNER, MASS.—The Gardner Electric Light Company, a corporation controlled by the Harriman interests, which control the Connecticut River Transmission Company, desires to issue 400 shares of preferred and 400 shares of common stock, to pay the cost of a transmission line to South Barre, and for distributing lines and substations in Westminster, Barre and Hubbardston; also for improvements to plant and distributing system in Gardner. W.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

PROVIDENCE, R. I.—It is stated that a new telephone station, to cost $75,000, will be built here.

FRESNO, CAL.—The School Board is considering the feasibility of installing a private telephone system.

ELK RIVER, MINN.—The Northwestern Telephone Exchange is planning some extensive improvements.

MOORHEAD, MINN.—The Council has granted the Tri-State Telephone Company admission for long-distance service. C.

THAYER, IOWA.—The Union & Clarke Telephone Company has been incorporated with a capital stock of $1,300.

MADISON, S. D.—The Franklin Telephone Company has been granted a franchise for rural-connection entrance. C.

WYMORE, NEB.—Wymore Independent Telephone Company has been organized with a caiptal stock of $25,000.

WATERTOWN, S. D.—The Dakota Central Telephone Company will install a local exchange with the automatic system. C.

GRUNDY CENTER, IOWA.—Voters of the city have approved a proposition to grant a 20-year franchise to the Local Telephone Company. Z.

ROCKFORD, ILL.—The Central Union Telephone Company is planning to build a new direct copper-metallic circuit from Rockford to Dixon. Z.

SAN FRANCISCO, CAL.—The Pacific Telephone & Telegraph Company has been granted permission to lay a new telephone cable across the Bay.

MOUNT PLEASANT, IOWA.—The Mount Pleasant Telephone Company proposes to place its wires underground, preparatory to erecting a new building. C.

ELKHART, IND.—The Board of Public Works has granted a franchise to the Indiana Telephone & Telegraph Company to construct and operate a toll-line system. S.

NEWARK, N. J.—The New York Telephone Company has been granted a 50-year franchise to construct and maintain a pole line in Mountain Avenue, North Caldwell.

ONAWA, IOWA.—The State Telephone Company proposes to spend $20,000 on improvements here, including a common battery system, new instruments and cables. Z.

GRAND FORKS, N. D.—The Tri-State Telephone Company plans improvements to its local system to cost $12,000 to $15,000. The cable system will be extended materially. C.

LAKEPORT, CAL. — The Lake County Telephone Association has applied for a franchise in this city. Sealed bids will be received up to November 4 for the sale of said franchise.

ORANGE, TEX.—The Southwestern Telephone & Telegraph Company has under consideration a plan to extend its telephone facilities here, including extending cables to all parts of the city.

COLCHESTER, ILL.—Colchester Farmers' Telephone Company has been incorporated with a capital stock of $6,000. The incorporators are Frank Stump, James M. Clayton and Louis A. Nuit.

TOWANDA, PA.—It is stated that the Bell Telephone Company of Pennsylvania will expend $10,000 on rebuilding its toll line between Waverly, Sayre and Towanda, a distance of about 22 miles.

AUGUSTA, ME.—The Automatic Telephone Company has filed articles of incorporation with a capital stock of $1,000,000. The incorporators named are Ernest L. McLean, E. M. Hussey, Augusta, and E. M. Leavitt, Winthrop.

LUVERNE, MINN.—The Northwestern Telephone Exchange Company will rebuild the local exchange of the Luverne Telephone Company, which it recently bought. A central-energy system will be installed, with cables, etc., at a cost of $20,000. C.

JACKSONVILLE, FLA.—The Ocala Telephone Company is preparing to rebuild its entire system in Ocala and surrounding territory. The system to be installed is known as the "drop" system and all telephone wires will be incased in lead cables.

PONTIAC, MICH.—Permission has been granted the Pontiac Exchange of the Michigan State Telephone Company to spend over $5,000 on more telephone lines between Pontiac and Detroit. It is stated that construction work will be started in the near future and rushed to completion.

ELKHART, IND.—The Board of Works has approved a 25-year franchise for the Indiana Union Telephone & Telegraph Company to conduct a long-distance telephone and telegraph business only. The franchise if passed by the Council will be non-exclusive and forbids the company to attempt any local service. Z.

COLUMBUS, GA.—The Southern Bell Telephone & Telegraph Company announces that it will invest $100,000 in Columbus at once. There will be a new exchange building and new telephone equipment to the amount of $60,000. About $20,000 will be used on outside work in the way of pole lines, cables, etc.

ELECTRIC RAILWAYS.

(Special Correspondence.)

FLUSHING, L. I.—It is stated that plans have been consummated for the use of the trackless trolley here.

JERSEY CITY, N. J.—It is reported that plans are under way for electrifying the Newark line of the Central Railroad of New Jersey.

PITTSBURGH, PA.—It has been announced that the West Penn Railways Company will extend its lines from Masontown to Point Marion and thence to Morgantown, W. Va.

HAMILTON, ONT.—The Dominion Power & Transmission Company is credited with a plan to build a fast electric line between Hamilton and St. Catherines. Right-of-way options have been secured.

OMAHA, NEB.—The residents of the Hanscom Park district are making decided efforts to have the Hanscom Park car line extended to South Omaha and the South Omaha people are cooperating in the movement.

WATERBURY, CONN. — It is planned by those holding charter rights to do so, to construct a trolley line

from this city to the Hitchcock Lakes before the winter sets in. It is also planned to complete the line to Dickerman's Corners next spring.

WACO TEX.—The Southern Traction Company will extend the Providence Heights electric line to Highland Place in Northwest Waco. D.

SAN FRANCISCO, CAL.—The high tension wires of the United Railroads now overhead on Fillmore Street will be laid in conduits on Webster Street from Turk to Broadway by July 1, 1913. The cost is estimated at $60,000.

WOODLAND, CAL.—The Sacramento Valley Railroad has started to survey its proposed line, which is to run from Redding to the terminal of the Oakland-Antioch-Eastern Railroad, southeast of Dixon, taking in several cities en route.

NEVADA, MO.—The citizens at this place have accepted the proposition from Thompson Brothers of Kansas City to build an electric interurban from here to Lebanon, Nevada, to furnish right of way through Vernon County and raise a bonus of $40,000, to be paid when the line is completed.

DETROIT, MICH.—It is reported that arrangements have been made to finance an interurban line between St. Joseph and this city, which will complete the only gap between Chicago and Detroit. The backing is said to come from the Kalamazoo-Grand Rapids line.

BROOKVILLE, IND.—The City Council has granted a 25-year franchise to the Indianapolis & Cincinnati Traction Company to operate cars through the city. This is regarded as settling the route for the Cincinnati extension of the road from Rushville *via* Brookville & Harrison. S.

NEW CASTLE, IND.—The Muncie & Newcastle Traction Company, controlled by the Indiana Union Traction Company, has been granted a franchise right of way into the City of Muncie. Rights of way are being secured for a line between the two cities which will be built early next year. S.

SACRAMENTO, CAL.—The Vallejo & Northern Railroad has applied for permission to issue $5,500,000 in bonds for the purpose of constructing an electric line between Sacramento and Vallejo, with ferry service to San Francisco. This company, while a separate corporation, will operate as an extension of the Northern Electric Railroad.

MUSKEGON, MICH.—It is stated that the Lake Shore electric line from Muskegon to Manistee is now sure of being built. Those interested in the project are John Q. Ross, Sidney M. Weil and Consulting Engineer R. W. Harris, who, it is reported, have been successful in interesting capital to finance the project.

RENSSELAER, IND.—Chief engineer E. A. Wilson and General Manager Eugene Purtelle have completed the survey of the Indiana and North Western Traction Company's interurban road between Rensselaer and Dyer and have let a contract for the grading. Manager and engineer offices have been opened in Rensselaer. S.

LOS ANGELES, CAL.—The City Council has decided to offer for sale a franchise for a line of the Los Angeles Railway Company over Main Street. The franchisce is to be sold for a sum not less than $100 and requires the completion of the line within 15 months after the franchise becomes effective, and work of construction is to be started within six months after that date.

RED BLUFF, CAL.—Melville Dozier, Jr., who for a number of years has been identified with railroads in this state, has outlined plans for an electric railroad through the Sacramento and San Joaquin Valleys, with terminals at Red Bluff and Oakland. Three routes were outlined and it is almost certain that the route offering the best inducements as to right of way and purchase of stock in the road will win out. It is estimated that the cost of construction is about $5,000,000.

KEOKUK, IOWA.—I. A. Smith, of St. Louis, Mo., representing a London, England, syndicate of capitalists, has been investigating the plausibility of building an interurban railroad from Springfield, Ill., through the towns of Jacksonville, Winchester, Pittsfield, Barry, Liberty and Quincy, with a stem to Hannibal, Mo., and, it is believed, reported favorably on the enterprise. The decision is now in the hands of the syndicate, who, it is said, will entirely finance the construction if the road is built.

GUADALAJARA, MEX.—The Government of the state of Jalisco has granted a concession to Rosalio Echeverria, an engineer of this city, for the construction of an interurban electric railway between Guadalajara and Lake Chapala. The proposed line will run to La Barca and Ocotlan, which are noted pleasure resorts, and will be about 70 miles long. It is stated that Mr. Echeverria has succeeded in financing the project and that construction will be started as soon as the surveys and other preliminary work can be accomplished. D.

NEW YORK, N. Y.—The New York Municipal Railway Corporation has been incorporated with a capital stock of $2,000,000. The directors of the company are Anthony N. Brady, J. Horace Harding, Walter G. Oakman, John T. Grier, James C. Brady, and others, all of Brooklyn, N. Y. The certificate of incorporation of the new company, which is organized in the interests of the Brooklyn Rapid Transit Company, gives it power to operate an enlarged rapid transit system, and to construct and own such parts of the system as are scheduled for private rather than public ownership.

PROPOSALS.

ELECTRICAL EQUIPMENT.—M. M. Ingles, electrical engineer, Yorkton, Sask., Can., will receive bids until October 31 for furnishing 500-horsepower Diesel engine, tungsten street-lighting apparatus, etc.

ELECTRICAL EQUIPMENT.—The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will open bids on November 5 for the electrical equipment given in the table below. Schedules may be obtained upon application to the Navy Pay Office nearest each navy yard.

CLOCK SYSTEM.—Sealed proposals will be received at the office of the Commissioner of the District of Columbia, Washington, D. C., until October 15 for furnishing and installing an electric time-and-program-clock system in the James Ormond Wilson Normal School, this city. Specifications and form of proposal may be obtained from the Purchasing Officer.

ELECTRIC APPARATUS.—Sealed proposals will be received at the office of the General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., until October 30 for furnishing electrically-driven fire pumps and transformers for the New Colon waterworks, as per Canal Circular 739, copies of which may be obtained from the Assistant Purchasing Officer in any of the large cities.

ELECTRIC CONDUITS AND WIRING SYSTEM AND INTERIOR LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until November 12 for furnishing electric conduits and wiring system and interior lighting fixtures for the one-story extension of the post office at Harrisburg, Pa. Drawings and specifications may be obtained from the custodian of the site or from the office of the Supervising Architect.

NEW INCORPORATIONS.

CEDAR RAPIDS, IOWA.—The Ball Electric Company has been granted articles of incorporation with a capital stock of $10,000.

SAINT CLAIRSVILLE, O.—The Sunnyside Electric Company has been incorporated with a capital stock of $10,000 by W. C. Anderson.

BOSTON, MASS.—The Orswell Electric Company has been incorporated with a capital stock of $50,000 by Israel C. Orswell, Annie E. Orswell and Joseph R. Fuller. W.

BARABOO, WIS.—Midwestern Electric Manufacturing Company has been incorporated with a capital stock of $25,000 by Michael Debrey, C. F. Kindschi and others.

SEATTLE, WASH.—J. J. Agutter & Company has been incorporated with a capital stock of $10,000 to do a general electrical business. John J. Agutter and P. E. Ridings are the incorporators.

HARRISBURG, PA.—The Lower Gwynedd, Upper Gwynedd and Montgomery Township Electric Companies have been incorporated with a capital stock of $5,000, and will maintain officers in West Chester.

LOGANSPORT, IND.—The Rutenber Electric Company has been incorporated with a capital stock of $50,000, to manufacture electric devices. The incorporators are E. A. Rutenber, J. F. Rutenber, J. F. Digan and J. E. DeLong. Z.

CONNELLSVILLE, PA.—A state charter has been issued to the Fayette Electrical Engineering Company, having a capital stock of $5,000. The incorporators are E. T. Lyne, C. M. Maxwell and H. A. Porter, all of this place.

Article.	Quantity.	Delivery at navy yard.	Schedule
Cable, lead-covered	3,600 feet	Puget Sd., Wash.	4880
Cable, single-conductor	6,000 feet	Newport, R. I.	4892
Cable, electric	15,840 feet	do	4892
Conductor, double, flexible insulated	100,000 feet	Brooklyn, N. Y.	4889
Transformers, mine	12	Newport, R. I.	4892

FINANCIAL NOTES.

Conditions in the market generally show a marked difference to those which obtained about this time a year ago. Not only is the outlook for crops better and bigger, but this year's market has been called upon to consider genuine expansions in distributive trade as indicated by steady increases in railway gross tonnage, diminishing surplus of idle cars, expending of bank clearances, and marked activity in both the steel and copper industries.

Harris Trust & Savings Bank Company, Chicago, is offering $5,000,000 of the Pacific Gas & Electric Company, general and refunding five per cents at 91.5 and interest. This issue is authorized by the Railroad Commission of California. $20,000,000 worth of these bonds were offered about eight months ago, and were quickly oversubscribed. The proceeds of the bonds now offered are being used for the development of two water-power plants which will add approximately 50,000 horsepower to the present capacity.

The Washington Railway & Electric Company, the Potomac Electric Power Company and allied companies are reported to be planning a $100,000,000 fifty-year five-per-cent bond issue.

General Electric Company will pay the one-half-of-one-per-cent secured debt tax on its new five-per-cent debenture bonds of September 2, 1912, which will entitle them to exemption in the future from personal tax.

Blair & Company and Ladenburg Thalman & Company are offering at 97.5 and interest, to yield over 5.30 per cent, the unsold balance of $10,000,000 convertible five-per-cent ten-year gold debentures of the Philadelphia Company. A simultaneous offering of these bonds is being made in London by James Chapel & Company.

J. P. Morgan & Company, and Lee, Higginson & Company, announce that owing to the heavy oversubscription for the $10,000,000 five-per-cent General Electric debentures, the subscription books which were formally opened at 10 a. m., closed at 10:30 a. m. the same day.

A cable dispatch states that the subscription books in London were promptly closed, as the offering made in London by Morgan, Grenfell & Company and Higginson & Company was also oversubscribed.

Stone & Webster have sold a new issue of $550,000 six-per-cent-cumulative preferred stock of the Eastern Texas Electric Company at 90 to yield 6.35 per cent. This company, under Stone & Webster management, owns the securities of the company doing the entire electric lighting and power business of Beaumont, Tex. The proceeds from the sale of this issue of preferred stock will be applied to the purchase of the electric lighting, power and refrigeration properties in Port Arthur, about 20 miles distant from Beaumont, and to further additions and improvements.

It is understood that the Boston Edison Illuminating Company is planning to increase the present capital by $2,000,000, making a total of over $18,000,000. The stock is to be paid for in two payments of $115 per share on December 12 and $100 per share on May 2, 1913. One new share is to be issued at $215 for every six shares subscribed. It was stated that the rights would sell for about $9. This stock is now paying twelve per cent. The receipts for payments will bear interest at four per cent and the stock will be delivered in May.

Stockholders of the Wireless Liquidating Company, organized to liquidate the United Wireless Company, have voted unanimously to distribute the company's holdings of Marconi stock among the shareholders and not to admit to the reorganization any stockholders who have not already deposited shares with the liquidating company. The Reorganization Committee has already announced that approximately 650,000 shares of the United Wireless has been deposited, calling for insurance of 325,000 shares of the liquidating company's stock. The liquidating company received for the physical assets of the United Wireless Company, 140,000 shares of the Marconi Wireless Telegraph Company's stock (par value $5). It is this stock which is now to be distributed.

Stockholders of the San Antonio & Rio Grande Valley Interurban Railway Company have authorized the issuance of bonds to the amount of $10,000,000. The proceeds of the bond issue are to be used in the construction of about 250 miles of additional track that will gridiron the extreme southern part of Texas and serve as a feeder to the lines of the Frisco Railroad, which is said to be back of the project. It is to be distinctly a farmers' transportation enterprise, the primary purpose being to place every tract of cultivated land in the lower Rio Grande Valley and the Gulf coast region within one mile of the railroad. The system already has 45 miles completed and in operation.

Dividends.

American Light & Traction Company; the regular quarterly dividends of 1.5 per cent on the preferred, 2.5 per cent on the common, and 2.5 per cent in common stock, on the common stock. Dividends are payable November 1 to stock of record October 16.

Brooklyn City Railroad Company, regular quarterly dividend of two per cent payable October 15 to stock of record October 1.

Dallas Electric Corporation; a semi-annual dividend of 2,500 second preferred, and three per cent on first preferred, both payable October 14.

Edison Electric Illuminating Company of Boston; a quarterly dividend of three per cent, payable November 1.

Electrical Utilities Corporation; an initial quarterly dividend of 0.5 per cent on the common stock; also the regular quarterly dividend of 1.25 per cent on the preferred stock, both payable October 15 to stock of record September 30.

General Gas & Electric Company; a quarterly dividend of 1.5 per cent on the preferred stock.

Lehigh Valley Transit Company; a preferred dividend of one per cent, payable November 10.

Pacific Telephone and Telegraph Company, the regular quarterly dividend of $1.50 per share on the preferred stock, payable October 15.

Public Service of Northern Illinois; the regular quarterly dividends of 1.5 per cent on the preferred and one per cent on the common stocks, both payable November 1.

Railway Storage Battery Company; a cumulative preferred dividend of 1.75 per cent, payable October 5 to stock of record September 25.

Sierra Pacific Electric Company; the regular quarterly dividend of $1.50 on the preferred stock, payable November 1 to stock of record October 16.

West Penn Traction Company; a regular quarterly dividend of 1.5 per cent on the preferred stock, payable October 15 to stock of record October 7.

Reports of Earnings.

STONE & WEBSTER PROPERTIES.

The following gas and electric companies under the management of Stone & Webster report earnings for August and twelve months ended August 31, as follows:

	1912	1911
BLACKSTONE VALLEY GAS & ELECTRIC.		
August gross	$ 98,629	$ 89,545
August net	26,328	25,338
Surplus after charges	17,326	16,745
Twelve months gross	1,183,433	1,104,730
Twelve months net	351,202	305,274
Surplus after charges	244,926	203,445
DALLAS ELECTRIC CORPORATION.		
August gross	$ 147,351	$ 129,851
August net	59,122	39,741
Surplus after charges	34,455	20,449
Twelve months gross	1,746,018	1,571,151
Twelve months net	641,477	529,822
Surplus after charges	371,350	279,873
EL PASO ELECTRIC.		
August gross	$ 63,401	$ 50,588
August net	28,086	18,575
Surplus after charges	22,727	11,817
Twelve months gross	750,767	671,628
Twelve months net	335,111	266,324
Surplus after charges	255,243	186,020
GALVESTON-HOUSTON ELECTRIC.		
August gross	$ 199,208	$ 142,326
August net	95,287	59,766
Surplus after charges	61,622	40,929
Twelve months gross	1,835,280	1,447,727
Twelve months net	735,995	535,602
Surplus after charges	388,484	297,258
NORTHERN TEXAS ELECTRIC.		
August gross	$ 147,202	$ 135,529
August net	68,370	61,512
Surplus after charges	47,512	39,935
Twelve months gross	1,669,796	1,561,348
Twelve months net	765,325	705,692
Surplus after charges	514,589	469,144

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Oct. 7.	Sept. 30.
American Tel. & Tel. (New York)	144¼	145¾
Commonwealth Edison (Chicago)	139¼	138½
Edison Electric Illuminating (Boston)	277	272½
Electric Company of America (Philadelphia)	*12¼	*12¼
Electric Storage Battery common (Philadelphia)	56	56⅜
Electric Storage Battery preferred (Philadelphia)	56	56⅜
General Electric (New York)	183	183¼
Kings County Electric (New York)	129	129
Manhattan Transit (New York)	1¼	1½
Massachusetts Electric common (Boston)	19¾	20
Massachusetts Electric preferred (Boston)	78	79
National Carbon common (Chicago)	125¼	128
National Carbon preferred (Chicago)	119¼	118
New England Telephone (Boston)	153	153½
Philadelphia Electric (Philadelphia)	23¼	23⅝
Postal Telegraph and Cables common (New York)	86¼	87½
Postal Telegraph and Cables preferred (New York)	68¼	68⅜
Western Union (New York)	81⅜	81¼
Westinghouse common (New York)	84½	85¼
Westinghouse preferred (New York)	122½	*125

*Last price quoted.

TAMPA ELECTRIC.

August gross	$ 62,981	$ 56,408
August net	30,264	24,756
Surplus after charges	25,729	19,654
Twelve months gross	739,140	627,172
Twelve months net	348,242	275,865
Surplus after charges	294,269	217,032

SAVANNAH ELECTRIC.

August gross	$ 64,073	$ 58,681
August net	16,457	15,304
Surplus after charges	304	8
Twelve months gross	732,185	668,755
Twelve months net	191,219	184,611
Surplus after charges	1,332	1,377

SIERRA PACIFIC ELECTRIC.

August gross	$ 51,785	$ 51,141
August net	31,370	32,001
Surplus after charges	25,919	29,420
Twelve months gross	608,961	568,003
Twelve months net	364,548	359,786
Surplus after charges	311,979	314,837

METROPOLITAN WEST SIDE ELEVATED.

The Metropolitan West Side Elevated Railroad Company reports for the six months ended June 30, 1912, as follows:

Gross	$1,501,613
Operating expenses	772,752
Net	728,860
Interest and taxes	538,653
Surplus	190,207
Dividends	130,618
Surplus	59,588

BOSTON ELEVATED.

The annual report of the Boston Elevated for the year ended June 30, 1912, is issued. The income account compares with the year ended June 30, 1911, as follows:

	1912	1911
Gross income	$15,904,046	$15,635,965
Operating expenses	10,976,634	10,119,064
Net	4,927,412	5,516,901
Other income	618,495	344,742
Total net	5,545,907	5,861,643
Charges and depreciation	4,840,539	4,511,182
Balance	705,368	1,350,460
Dividends	1,197,000	1,197,000
Deficit	491,631	*153,460

*Surplus.

NEW ENGLAND TELEPHONE & TELEGRAPH.

The New England Telephone & Telegraph Company reports to the Massachusetts Highway Commission for the year ended June 30, 1912, compared as follows:

	1912	1911
Gross earnings	$14,239,387	$13,085,221
Total net	4,218,892	3,827,420
Surplus after charges	3,143,974	2,888,105
Dividends	2,742,467	2,448,631
Surplus	401,507	439,474

PERSONAL MENTION.

FRANK K. SHUFF has resigned the general managership of the Boone Electric Company, Boone, Iowa, to become superintendent of the Fort Dodge, Des Moines & Southern Interurban Company.

R. L. CLARKE, general manager of the San Diego Consolidated Gas & Electric Company, has been elected a director of the Pacific Coast Gas Association, whose twentieth annual convention was held in San Diego last month.

WILLIAM BURNETT has been appointed superintendent of electrical construction for the Champaign & Urbana Street Railway, Gas & Electric Company, to succeed J. D. McKee, who has associated himself with the Ideal Electric Company.

F. L. GILMAN has resigned as general manager of the Missouri & Kansas City Telephone Company to associate himself with the Western Electric Company. Mr. Gilman will have charge of that company's large shops at Hawthorne, Ill.

HAMMOND V. HAYES, consulting engineer, Boston, Mass., is acting on behalf of the National Telephone Company in the appraisal investigation of that company's properties which were taken over by the British Post Office Department last January.

JAMES F. McLAUGHLIN, Philadelphia, Pa., has been appointed by the Board of City Commissioners, Atlantic City, N. J., to prepare a model code of electrical regulations for that city. Mr. McLaughlin has been retained for three months at a salary of $500 a month.

H. F. MAC GREGOR, of Houston, Tex., Second Past Jupiter of the Sons of Jove, was in Boston during the first week of the electrical show, which he took the opportunity of visiting on Wednesday. Mr. MacGregor is national committeeman of the Republican party in Texas.

BENJAMIN S. REED, who was elected general manager of the Bell Telephone Company of Missouri following the reorganization of the company last March, has been chosen general manager of the Missouri & Kansas Telephone Company, with headquarters in Kansas City.

NATHANIEL A. CARLE, EDWARD B. MEYER, N. L. POLLARD and S. H. HUNT have been appointed by the Public Service Electric Company of Newark, N. J., respectively to the positions of chief engineer, assistant chief engineer, electrical engineer and mechanical engineer.

F. R. COATES, E. R. KELSEY and H. S. SMITH, respectively president, publicity manager and auditor of the Toledo Railways & Light Company, motored to Chicago from Toledo to attend the convention of the American Electric Railway Association. They expressed the intention of having Toledo designated as the next meeting place of the association.

RENZO NORSA has resigned his position with H. M. Byllesby & Company and will go to Milan, Italy, to take up private consulting-engineering work. Mr. Norsa is a native of Milan and attended the university there. He has been connected with the Examination and Reports Department of H. M. Byllesby & Company. Mr. Norsa expects to return to this country in the course of a few years.

W. H. HODGE is writing a series of articles on the subject of Public Utilities for the *Chicago Evening Post*. The first of these appeared on September 21, under the title, "Winning the Public." The article deals with the mutual attitude of utility corporations and their customers and discusses the difficulties which corporations have encountered in winning public confidence. Mr. Hodge occupies the position of publicity manager with H. M. Byllesby & Company.

R. J. MACK, manager of the New Business Department of the Fort Smith Light & Traction Company, is secretary of the Arkansas-Oklahoma Interstate Fire Association. In this capacity a great deal of the labor incident to making preparations for the fair to be held this autumn rests upon Mr. Mack's shoulders. The fair held last year under his secretaryship was a success from every standpoint and it is expected that this year's event will be even more successful.

DUGALD C. JACKSON, head of the Department of Electrical Engineering, Massachusetts Institute of Technology, has gone to England on a leave of absence until January 1. He will act with the commission on behalf of the British Post Office Department that is concluding the appraisal of the National Telephone Company's system which was taken over by the Government on the first of this year. Professor Jackson is the only foreign expert consulted in this matter by the British Government and has already made several trips to England on account of it. During his present leave of absence some of his lecture work will be given by Comfort A. Adams, of Harvard University.

OBITUARY.

ALBERT UNGER died September 29 at the Toledo State Hospital, where he had been a patient for some time. Mr. Unger was formerly manager of the Bucyrus Telephone Company, Bucyrus, O.

EDWARD G. DUNKEL, expert electrician and chief apparatus installer for the Home Telephone Company, Dayton, O., was almost instantly killed when an automobile, which he was driving, crashed into a heavy pole on October 5. Interment was at Cincinnati.

WILLIAM HORACE CORBIN, vice-president of the Joseph Dixon Crucible Company, died on Wednesday, September 25, at Jersey City, N. J. The Joseph Dixon Crucible Company is at this time making a fitting announcement of its profound sorrow at the death of its honored and beloved officer.

JOHN J. PATTERSON, former United States Senator from North Carolina, and one of the pioneers in the development of electric light and power, died on September 28 at his home in Mifflintown, Pa. He was born in Juniata County, Pa., in 1830, and in his early career was a newspaper man, associated with Senator Don Cameron. He served in the Civil War with the rank of colonel and after the war went to North Carolina. After serving a term as senator he was a builder of electric light and power plants and electric railways. His operations extended over Indiana, Illinois and Michigan.

ALFRED F. MOORE, widely known wire manufacturer of Philadelphia, Pa., died at his home in that city on September 18. Mr. Moore, who was in the fifty-ninth year of his age, was a native of Philadelphia, and a member of one of the city's oldest and most representative families. The business of which he was the active directing head, located at Third and Race Streets, Philadelphia, was established by his grandfather nearly a century ago. Mr. Moore began his business career in 1870, when he entered the employ of the firm of Joseph Moore & Son, composed of his father and brother. Later he was admitted to partnership, the name being changed to Joseph Moore & Sons. In 1878, some time after the decease of the other partners, the name of the firm was changed to, and still remains, Alfred F. Moore. No change will be made in the firm name. At the time Mr. Moore became connected with the business, the electrical field was extremely limited and the business of the firm consisted largely in the manufacture of wire for bonnets and hats. There was also a considerable trade in cotton and silk-covered magnet

wire for winding telegraph instruments, medical batteries and some few other types of electric appliances. After 1878 there were tremendous strides in electrical progress, and Alfred F. Moore was a pioneer in the manufacture of all kinds of insulated wire and flexible cords for the new applications of electricity. Mr. Moore had been prominently identified with the activities of the Union League of Philadelphia, having been a member since 1884, and vice-president of the Club in 1901. He was also a member of the Bachelors Barge Club. The commercial institutions with which he was connected were many. He was at the time of his death a director in the Franklin Fire Insurance Company, the Second and Third Streets Passenger Railway Company, president and trustee of the Northern Liberties Gas Company, and vice-president and director of the County Fire Insurance Company. He was formerly a member of the Board of Directors of the House of Refuge. He was a director of the National Bank of Northern Liberties, of which his brother, Joseph Moore, is president.

NEW PUBLICATIONS.

NEW YORK COMMISSION REPORT.—The fifth annual report of the Public Service Commission, Second District, of New York, for the year 1911, has appeared in two volumes. Appended to the report are reports of public-utility companies and the orders of the Commission handed down during the year.

SOUTHWESTERN ASSOCIATION.—The *Proceedings* of the sixth annual convention of the Southwestern Electrical & Gas Association held at Beaumont, Tex., in May, 1910, has come from the press. This publication was greatly delayed and the volumes for 1911 and 1912 will soon follow. The *Proceedings* are bound in cloth and the typography is excellent.

WIRELESS REGULATIONS.—The Bureau of Navigation, Washington, D. C., has issued a pamphlet containing regulations governing radio communication. This gives a list of the places at which examinations of operators will be held for obtaining licenses, and a summary of the regulations which have been adopted for the control of wireless sending. The regulations applying to licenses and applications for the same are also given.

GREATER NEW YORK BOOKLET.—The Publicity and Convention Bureau of the New York Hotel and Business Men's League has issued a pamphlet entitled "Greater New York —The Ideal Resort and Convention City," which gives very useful information concerning the city, especially in regard to hotels, theaters and transportation rates, including Pullman fares, to principal cities in the United States and Canada and steamships to all parts of the world. M. C. Roach, Cambridge Building, New York City, is director of publicity of the Bureau.

RATE RESEARCH.—The Rate Research Committee of the National Electric Light Association, with offices at 120 West Adams Street, Chicago, has begun the publication in printed form of a bulletin which has been circulated during the past year in mimeograph form. The first number of the new volume, dated October 2, contains, in addition to the editorial announcement, an abstract of the decision in the Des Moines Gas case and references to current literature on the subject of rates, etc. The subscription price of the bulletin is $25 to Class A members (three copies), and $10 to Class B members.

TEACHING MATHEMATICS.—The report of the Committee of the Society for the Promotion of Engineering Education on Teaching Mathematics to Engineering Students has been reprinted in cloth binding. The report includes a synopsis of the fundamental principles and methods which, in the opinion of the Committee, should constitute the minimum mathematical equipment of the student of engineering. The synopsis covers syllabi of elementary algebra, plain trigonometry, calculus, and elementary dynamics, numerical computation and the solution of equations, and geometry. This report will indicate to teachers of engineering the preparation which they may reasonably expect their students to have had, and will also serve as a reference for engineers who wish to systematize their knowledge of mathematics. A charge of 75 cents is being made to cover the cost of printing. Copies may be secured from the secretary of the Society, Henry H. Norris, Cornell University, Ithaca, N. Y.

With the Electrical Manufacturers

The Delta-Star Electric Company, Chicago, Ill., is distributing a very complete bulletin on S & C fuses and weatherproof mountings for use on all potentials up to and including 66,000 volts. Especial attention is called to the type of fuse mounting used in protecting outdoor substations.

Clapp-Eastham Company, 139 Main Street, Cambridge, Mass., has issued several circulars and price lists of its wireless-telegraph outfits and parts thereof. Among these are descriptions of a new type D commercial receiving set, wireless head receiver, the Blitzen transformer, the Hytone rotary-gap quenched-spark transmitting set, the Blitzen variable condenser, etc.

The Earle Gear & Machine Company, Philadelphia, Pa., has issued a bulletin on herringbone gears. This recites the relative value of this type of gear compared with ordinary spur gearing and shows that for many services the latter has decided limitations that are overcome by the herringbone construction. Brief reference is also given in the bulletin to spiral, beveled and worm gears.

S. R. Bailey & Company, Incorporated, Boston, Mass., manufacturer of the cording to a test made on June 11 by the Boston Edison Company, one charge of battery carried this car 103.2 miles at an average speed of 20.14 miles Bailey electric roadster, states that acper hour. The road was from Boston to Pawtucket, R. I., and return, a distance of 78 miles, the remainder of the run being around Boston.

The Union Light & Supply Company, Chicago, Ill., importers and distributors of the "Just" drawn-wire tungsten lamp, has established a New York office at 471 Hudson Terminal Building, 50 Church Street, in order to properly handle the constantly increasing demand for its lamp in the East. J. F. A. Comstedt, president of the company, has just returned from an eastern trip and reports the prospects of his company very promising.

The Columbia Incandescent Lamp Works of the General Electric Company was awarded a portion of the United States Government contract for incandescent lamps, mentioned on page 614 of our issue of September 28. This contract covers Mazda, Gem, and tantalum lamps for the year ending June 30, 1913. This is the third consecutive year in which the Columbia Works has participated in this contract, which speaks well for the performance of Columbia lamps.

The Ohio Brass Company, Mansfield, O., has issued a 60-page catalog of Tomlinson car-coupler equipments for electric railway service. Among these are automatic radial car couplers, automatic air-connecting car couplers, M. C. B. automatic couplers, spring drawbar carriers, draft gears and accessories. The bulletin is copiously illustrated with views of cars equipped with the various types of apparatus and of detailed views thereof. Copies of this catalog will be sent upon request to the company.

E. W. Manter Company, 755 Boylston Street, Boston, Mass., has been incorporated to do a general business in consulting illuminating engineering and sale of electrical products, such as the latest equipment in incandescent lamps, fixtures, glassware, illuminated signs, etc. Everett W. Manter, who is the president of the company, was until recently associated with the Bryan-Marsh Works of the General Electric Company as electrical engineer, and is well equipped to handle all kinds of illumination problems.

C. W. Hunt Company, West New Brighton, N. Y., has issued Catalog No. 12-8. This is a 52-page publication containing a treatise by C. W. Hunt on Manila rope for transmission and hoists. It traces the manufacture of Manila rope from the original hemp through its various stages. Many valuable data and diagrams are given in regard to the making and use of Manila rope and its splicing is discussed at some length. Appendices give a general discussion of rope driving, the Manila fiber industry and a bibliography of the subject.

General Fire Extinguisher Company, New York, N. Y., has issued a new bulletin dealing with Grinnell automatic sprinklers. In this 32-page bulletin are discussed the necessity of educating the general public to automatic fire protection, investigations made in the company's laboratory, the agitation to reduce fire hazards throughout the country, and installation of Grinnell sprinklers in a new York skyscraper, the plants, organization and facilities of the company and a general summary of the manufacturing processes from the raw material to the finished sprinkler equipment.

Detroit Fuse & Manufacturing Company, Detroit, Mich., has issued Catalog No. 21 devoted to Detroit ironclad fused switches and motor starters and Arkless indicating inclosed fuses. The switches are made double-pole and triple-pole and can be operated without opening the door of the box, this latter being necessary only in replacing fuses. The motor starters are of the three-phase type and are made for 250 and 600-volt circuits. The bulletin describes these types with the aid of numerous illustrations and dimensional diagrams. The methods of indicating whether a fuse is blown or not are shown in detail.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., reports that among recent orders received by its Railway Department were the following: Boston Elevated Railway Company for 20 equipments of type AL control for use in the Cambridge Subway—this is a duplicate of an order received some time ago; Northern Ohio Traction & Light Company, Akron, O., for 25 quadruple sets of No. 101-B-2 motors and K-28-B control; Public Service Railway Company of New Jersey for 10 quadruple equipments of No. 310-C-2 motors with double-end type HL field control; Stone & Webster Engineering Corporation for 12 double equipments of No. 307 motors and K-36-J control.

Crocker-Wheeler Company, Ampere, N. J., has issued an interesting brochure of 31 pages entitled "Ampere." This is well illustrated throughout and shows first the location of the company's works and how they may be reached from New York City. The railroad station, post office and a great many views of the works at Ampere are shown. Then follows a brief history of the organization of the company, which began its manufacturing as early as 1886 as the C. & C. Electric Company. Brief personal sketches of Dr. Schuyler Skaats Wheeler, president of the company, and of Prof. Francis Bacon Crocker are given. The organization and policy of the compay, a summary of its balance sheet, brief descriptions of its plant, equipment and products conclude the book.

DATES AHEAD.

The 1912 Boston Electric Show September 28 to October 26.

The New York Electrical Exposition and Automobile Show. The New Grand Central Palace, New York City, October 9-19.

Sons of Jove. Annual convention, Pittsburgh, Pa., October 14-16.

New England Section of the National Electric Light Association. Fall meeting, Boston, Mass., October 15-17.

Kansas Gas, Water, Electric Light and Street Railway Association. Annual meeting, Manhattan, Kans., October 17-19.

Association of Railway Electrical Engineers. Annual convention, Chicago, Ill., October 21-24.

Illinois State Electrical Association. Annual convention, Peoria, Ill., October 22-24.

Old Time Telegraphers' and Historical Association and the Society of the United States Military Telegraph Corps. Annual convention, Jacksonville, Fla., October 22-24.

Indiana Electric Light Association. Annual convention, Indianapolis, Ind., October 30 and 31.

Electrical Supply Jobbers' Association, Hot Springs, Va., November 13-15.

Association of Telephone Pioneers of America. Annual convention, New York City, November 14-15.

Alabama Light and Traction Association. Birmingham, Ala., November 14-15.

American Mining Congress. Fifteenth annual meeting, Spokane, Wash., November 25-28.

American Society of Mechanical Engineers. Annual meeting, New York, N. Y., December 3-6.

American Association for Advancement of Science and affiliated societies. Annual meeting, Cleveland, O., December 30-January 4, 1913.

American Institute of Chemical Engineers. Annual meeting, Detroit, Mich., December 4-6.

Western Association of Electrical Inspectors. Annual meeting, St. Louis, Mo., January 28-30, 1913.

Record of Electrical Patents.

Issued by the United States Patent Office, October 1, 1912.

1,039,682. Fan-Motor Oscillator. C. Aalborg, assignor to Westinghouse Electric & Manufacturing Co. The shaft of a trunnioned fan motor drives a vertical crank shaft through worm gearing and the crank shaft eccentrically drives the oscillator through a connecting rod.

1,039,685. Power-Transmission Device. V. G. Apple, Dayton, O. A rolling magnetic-wedge clutch is interposed between a gasoline engine and a motor-generator so either may drive the other.

1,039,703. Gear Case for Dynamo-Electric Machines. J. F. Curtis, assignor to Westinghouse Electric & Manufacturing Co. A split case for a railway motor.

1,039,715. Machine for Pasting Storage-Battery Grids. F. Engel, assignor to United States Light & Heating Co., New York, N. Y. The paste is applied simultaneously from both sides and revolving blades pack it in and scrape off the surplus.

1,039,717. High-Frequency Electrical Conductor. R. A. Fessenden, assignor to National Electric Signaling Co., Pittsburgh, Pa. A high-frequency coil wound edgewise with a strip conductor composed of a number of wires spirally arranged.

1,039,722. Knockout Closure in Wall Boxes. J. M. G. Fullman, Pittsburgh, Pa. The knockout and hole have corresponding serrations of different size that are hammered together.

1,039,724. Automatic Mileage Registering and Auditing Apparatus. J. T. Gallaher, Knobnoster, Mo. Entrance and exit of passengers electromagnetically controls the printing means.

1,039,732. Electric Furnace. E. A. A. Grönwall, A. R. Lindblad and O. Stalhane, Ludvika, Sweden. Electrodes project obliquely into the chamber through its cover.

1,039,744. Railway Signaling. J. S. Holliday, assignor to Union Switch & Signal Co., Swissvale, Pa. Special relays control the stop, caution and clear signals for a single-track road.

1,039,767. System of Electrical Distribution. P. M. Lincoln, assignor to Westinghouse Electric & Manufacturing Co. A single-phase railway has distant sections supplied with generator voltage, nearby stations supplied with lower voltage through auto-transformers, and intervening sections arranged so they may be supplied through either near or distant sections.

1,039,773. Telephone Switchboard. E. S. McLarn, assignor to Western Electric Co., New York, N. Y. A private-exchange board built up of superposed sections.

1,039,799. Suspension Chain for High Pressure Electric Transmission Lines. C. M. E. Priestley, assignor to Société Dovelli, Priestley et Compagnie, Paris, France. A link for a suspension insulator is formed of a piece fashioned like two saddles fitted together at right angles, each having a transverse hole where the wing makes a sharp bend.

1,039,810. Cutout for Electric Heating Devices. E. E. Rose, assignor to Westinghouse Electric & Manufacturing Co. A flatiron has a thermostatic device for breaking the circuit when a certain temperature is attained.

1,039,822. Lighting Fixture. L. Schepmoes, Hasbrouck Heights, N. J., assignor to Safety Car Heating & Lighting Co. A car bracket with special socket-cover and shade-holder.

1,039,828. Electric Illuminated-Sign Apparatus. A. O. Siegel, New York, N. Y. Motor-driven arms carry incandescent lamps at the ends and one at the middle.

1,039,835. Combined Automatic Cut-off Switch and Lamp Socket. F. O.

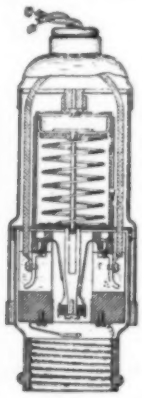
Stallman, San Francisco, Cal. A reciprocating plunger periodically closes the lamp circuit.

1,039,851 and 1,039,852. Method and Apparatus for the Carrying Out of Gas Reactions by Means of an Electric Arc. G. Wagener, assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. Compressed and preheated gas is subjected to the influence of an electric arc that is drawn out.

1,039,865. Internal-Combustion Engine. W. B. S. Whaley and A. L. Galusha, assignors to Reversible Gas-Engine Co., Portland, Me. The electric ignition devices of a reversible engine are prevented from operating until the valve gear and timer are completely shifted.

1,039,866. Internal-Combustion Engine. W. B. S. Whaley and E. P. Robinson, assignors to Reversible Gas-Engine Co. The distributing member of the electric ignition timer can be set to start the engine forward or backward.

1,039,867. Ignition Timer. W. B. S. Whaley and E. P. Robinson, assignors to Reversible Gas-Engine Co. Gives details of the timer and distributer for a reversible engine.



1,039,835.—Socket With Automatic Switch.

1,039,882. Electrically Heated Flat-iron. R. W. Baker, assignor to Parker-Clark Electric Co., Newark, N. J. The heating element is in filament form.

1,039,907. Secondary Battery. A. Henry Darker, Blackheath, England. Has two bridges for supporting one set of plates and a central lower bridge for the other set of plates.

1,039,918. Trolley-Wheel Retainer. J. H. Finch, Jr., Dorchester, Mass. Includes a special construction of trolley head and hanger.

1,039,925. Alternating-Current Measuring Device. B. Gáti, Budapest, Austria-Hungary. A shunted galvanometer is supplied with opposite currents from two battery circuits, the current to be measured being superposed on one of the branch circuits.

1,039,949. Primary Cell. C. Jaeger and B. Jaeger, Los Angeles, Cal. The electrolyte contains chlorides of ammonium, zinc, sodium, calcium and mercury, also china clay, flour, glue, glycerine and water.

1,039,955. Outlet Box. J. Keefe, assignor to J. H. Parker, Saugus, Mass. The knockouts have two sets of teeth of different size.

1,039,973. Unispark Ignition System. E. S. Lincoln, Brookline, Mass., assignor to Electric Goods Manufacturing Co. Includes a special induction coil and timer operated from a battery.

1,039,974. Combined Ignition and Working System. E. S. Lincoln, assignor to Electric Goods Manufacturing Co. Includes a generator, storage battery, lamps and ignition circuit.

1,039,975. Trolley. C. A. Lindberg, Bradford, Pa. A special construction of the harp.

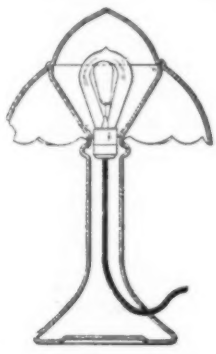
1,039,988. Controlling Apparatus. E. C. Molina, assignor to American Telephone & Telegraph Co. A selective signaling system actuated by key-controlled relays.

1,039,996. Signaling Means for Fire Alarms. C. Noack, assignor to Siemens & Halske A. G., Berlin, Germany. The alarm boxes control switching devices and lamp boards at the central station.

1,040,043. Electric Heater. F. H. Smith, assignor to Gold Car Heating & Lighting Co., New York, N. Y., The heater elements are independently removable.

1,040,050. High-Potential Insulator. L. Steinberger, New York, N. Y. A cylindrical insulating entrance bushing.

1,040,055. Battery. A. E. Thompson, assignor to Miners Electric Safety Lamp Manufacturing Co., Trinidad, Colo. The upper portion of the jar is of special massive construction.



1,040,072.—Portable Lamp.

1,040,056. Lamp. A. E. Thompson and J. Cameron, assignors to Miners Electric Safety Lamp Manufacturing Co. An electric lamp casing has two threaded sleeves and a ring for holding a lens.

1,040,072. Lamp. G. F. Wehr, assignor to Phoenix Glass Co., Pittsburgh, Pa. A portable with hollow glass stand having an integral flaring diffusing top and a doubly curved shade with a shoulder resting on top of the diffuser.

1,040,080. Electric Lamp and Supporting Bracket Therefor. G. Williams, assignor to English & Mersick Co., New Haven, Conn. The bracket has a contact pin engaging one terminal of the lamp.

1,040,089. Automatic Stabilizer for Aeroplanes. E. Yeamans, Collegeport, Tex. Includes a gyroscope driven by an electric motor.

1,040,107. Connecting Terminal. A. J. Allen, New York, N. Y. The end of the wire fits into a lateral pocket in a sleeve and is clamped by a screw.

1,040,109. Theatrical Appliance. E. H. Amet, Redondo Beach, Cal. A motion-picture screen has electrically operated sound reproducers near its edges.

1,040,110. System of Transmitting Images to a Distance. A. C. Andersen and L. S. Andersen, Copenhagen, Denmark. The colored image is projected point by point on a selenium cell and electrically transmitted to a similar receiving apparatus.

1,040,116. Apparatus for the Manufacture of Incandescent Lamp Filaments and Heaters. R. W. Baker, assignor to Parker-Clark Co., Newark, N. J. The filaments are flashed in an exhausted jar, a switch breaking the current when it reaches a certain value.

1,040,123. Ozonizer. H. E. Beck, Chicago, Ill. One electrode revolves with a fan, the other is separated from it by a thin dielectric.

1,040,131. Electric-Light Socket. T. A. C. Both, assignor to Zee Socket & Manufacturing Co., Boston, Mass. Has interlocking surfaces to hold together the base, center contact and screw shell.

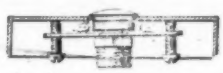
1,040,132. Mechanical Movement and Electric-Light Socket. T. A. C. Both, assignor to Zee Socket & Manufacturing Company. A spring switch for the socket.

1,040,149. Electric Signaling Device. F. W. Cole, assignor to Gamewell Fire-Alarm Telegraph Co., New York, N. Y. A spring-actuated and interlocked circuit-closer.

1,040,150. Indicator for Inclosed Fuses. R. C. Cole, assignor to Johns-Pratt Co., Hartford, Conn. The indicator wire has a portion passing an opening in the case.

1,040,151. Open-Link-Fuse Carrier. R. C. Cole, assignor to Johns-Pratt Co., Has a cylindrical body with integral wings and a barrier between them.

1,040,175. Adjustable Fixture Stud for Electric-Conduit Outlet Boxes. W. S. Earhart, Denver, Colo. The stud has a conical head seated in the hole in the box and carries a cruciform plate that can be screw-adjusted to make the stem vertical.



1,040,175.—Adjustable Fixture Stud.

1,040,212. Trolley-Wire Switch or Frog. J. Kirby, Douglas, Ariz. Has a special guard clamped to both the main and branch wires.

Patents That Have Expired.

Following is a list of electrical patents (issued by the United States Patent Office) that expired October 8, 1912.

547,441. Electric Bicycle. H. W. Libbey, Boston, Mass.

547,460. Telephone System. F. D. Shepard, Milwaukee, Wis.

547,536. Electric Car-Lighti .g Apparatus. W. Biddle, Brooklyn, N. Y.

547,537. Electric Car Lighting. W. Biddle and H. E. Dey, Brooklyn, N. Y.

547,568. Electric Key-Action for Pipe Organs. E. S. Votey, W. B. Fleming, and W. D. Wood, Detroit, Mich.

547,613. Telephone Switch. W. M. Miner, Plainfield, N. J.

547,659. Electric Arc Lamp. H. E. Bradley, Pawtucket, R. I.

547,660. Insulator Pin and Insulator. C. F. Carroll, Manistee, Mich.

547,714. Time-Controlled Electric Heater. I. E. Custer, Dayton, O.

547,753. Cutout for Arc Lamps. D. Higham, Boston, Mass.

547,755. Automatic Telephone System. G. K. Hutchins, Baltimore, Md.